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BOSTON

By WILLIAM H. TIMBIE

Professor of Electrical Engineering
Massachusetts Institute of Technology

To tell adequately about just the historical landmarks in and around Boston one would have to pretty nearly write a history of the United States, including the biographies of Samuel Adams, John Hancock, Paul Revere and numerous other early patriots. But the editor has limited me in space,. so I am going to start out with you on an hour's walk about Boston, and then make mention of such other places as space allows.

AN HOUR'S WALK IN HISTORIC BOSTON

We shall start on Atlantic Avenue at the site of the old Griffin's Wharf. Here on the night of December 16, 1773, were moored the three British ships on which the famous Boston Tea Party was held. As we walk along Atlantic Avenue we see an almost endless line of wharves, calling to mind the fact that Boston is now the second largest seaport in the United States in number of ocean-going passengers and in volume of imports, and has the largest dry dock in the country. It also has the most important fish pier in the Western Hemisphere.

Turning up what is now State Street (before the Revolutionary War it was King Street) we come to McKinley Square, the site of the Custom House, the tower of which, 495 ft. high, is a distinguishing feature of the Boston sky line. It will be worth our while to go up to the observation balcony, which is reached by elevators, for from here on a clear day is spread out a wonderful panorama of the city.

Continuing our walk up State Street, we ought to stop for a minute to note a circle of stones set in the pavement marking the spot of the "Boston Massacre," where fell the first martyrs in the cause of freedom. It was this act of the British soldiers in 1770 that intensified the public sentiment for a separation from England. At No. 28 State Street stood the Royal Exchange Tavern. From this point started the first stage coach to New York in 1772 "to go once every fourteen days." Across the street stood the first meeting house, "The First Church," built by the colonials in 1662.

At the head of State Street is the old State House where the General Court of Massachusetts met, and from the balcony of which were proclaimed the Repeal of the Stamp Act and the Declaration

BUNKER HILL MONUMENT

General Lafayette assisted in laying the corner stone of this memorial, June 17, 1825. *Courtesy of Boston Chamber of Commerce*

of Independence. This building was used as the headquarters of the British Army when it occupied Boston. The State House faces on Washington Street, which was so named because in 1789 the first President entered the city along this route. On the corner of

Court Street, across from the old State House, stood the printing office of James Franklin. It was here that his brother Benjamin learned the printing trade, and it was here in the "long club room" above the printing office that the early patriots held their meetings, which culminated in the outbreak of the revolution.

Walking up State Street to the corner of Tremont Street, we come to the present City Hall, built on the site of the former "Wendell Powell House," where George Washington lodged on his visit as President. A short distance down Tremont Street is King's Chapel Burying Ground, the first burying place in Boston. Here lie Governor John Winthrop, Reverend John Cotton, Governor

PUBLIC GARDEN, BOSTON

A tract of more than 25 acres, adjoining the Common in the heart of Boston.
Courtesy of Boston Chamber of Commerce

Shirley, and other early personages. On the corner of Tremont and School Streets is the Old King's Chapel, built in 1686, and rebuilt in 1749. This was the first Episcopal Church organized in New England, and also the first Unitarian Church in the United States. It contains many memorials of early American days. We must also go down School Street to the site of the first building in Boston erected for the use of the Boston Public Latin School. On the roll of Latin-School pupils are the names of Benjamin Franklin, John Hancock, Samuel Adams, Robert Treat Paine, Cotton Mather, Henry Ward Beecher, Edward Everett Hale, Phillips Brooks, Ralph Waldo Emerson, Francis Parkman; Presidents

Leverett, Langdon, Everett and Eliot of Harvard College; Charles Francis Adams, Sr., Charles Sumner and William M. Evarts.

Walking down School Street, we pass the site of the Cromwell's Head Tavern, and the building of the Old Corner Bookstore, the original of which was erected in 1712. It is still known far and wide as a center of literature, and meeting place for book lovers. We come again to Washington Street at the point where stood Samuel Cole's Inn, the first tavern opened in Boston. A little farther down Washington Street stood Paul Revere's shop, which furnished the brass and copper work for "Old Ironsides."

FANEUIL HALL, BOSTON

The Cradle of American Liberty.
Courtesy of Boston Chamber of Commerce

Diagonally across from the corner of School and Washington Streets is the famous Old South Meeting House. Here the men of the town of Boston gathered to protest forcing Massachusetts citizens into the English Navy, and to demand the withdrawal of British troops.

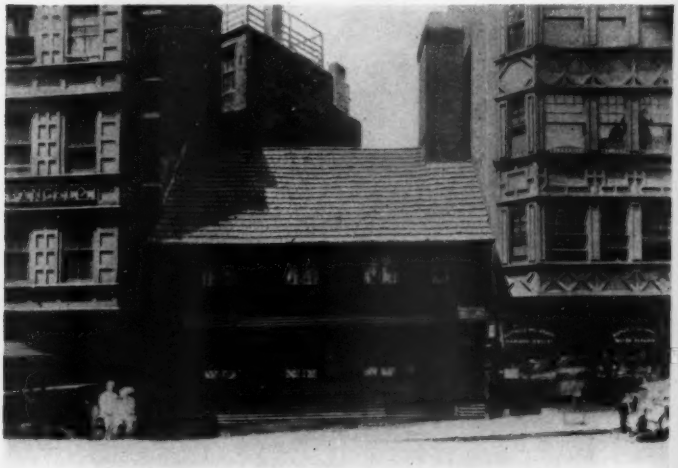
Walking down Milk Street from the Old South Church, we pass the birthplace of Benjamin Franklin, and the site of the home of Robert Treat Paine, one of the signers of the Declaration of Independence. Turning into Federal Street, a short walk brings us to Franklin Street where stands the Boston Chamber of Commerce,

OLD NORTH CHURCH

From the belfry of this church on the night of April 18, 1775, lanterns were hung which signalled to Paul Revere that the British troops were marching to Lexington and Concord. *Courtesy of Boston Chamber of Commerce*

built on the site of the old Presbyterian Meeting House, in which the State Convention of Massachusetts ratified the Constitution of the United States by a vote of 187 to 168. Walking up Franklin Street, we come again to Washington Street. We are now at the corner of Summer and Winter Streets, the busiest corner in the modern city.

Continuing up Winter Street, we reach the site of the house of Samuel Adams and get a view of Boston Common with its famous Frog Pond. The Common is one of the most historical places in New England, full of monuments and tablets commemorating historical events of early days. It is a tract of land of about fifty acres set apart in 1630 for "common use as a cow pasture and training field." Here the British artillery was stationed during the siege of Boston, and from here the British started for Lexington on that famous raid on April 18, 1775. Here the British mustered before Bunker Hill. Here mustered contingents for



PAUL REVERE'S HOUSE, BOSTON

The oldest house in Boston, built soon after the fire in 1676, and now used as a museum. *Courtesy of Boston Chamber of Commerce*

Colonial expeditions against Louisburg and Quebec. Here also many Massachusetts regiments assembled before going to the front in the Civil War.

Looking across the Common to Beacon Hill, we see the State House designed by Charles Bullfinch. Immediately in front of the State House is the Shaw monument, a memorial to Colonel Robert E. Shaw and the Fifty-fourth Massachusetts Regiment of the Civil War.

Park Street Church stands on the famous Brimstone Corner, so called because in the War of 1812 gun powder was stored in the

basement. Here also on July 4, 1832, "America" was first publicly sung. To the right of the church is the Granary Burying Ground where lie many personages of historic Boston, including Peter Faneuil, Paul Revere, the parents of Benjamin Franklin, the victims of the Boston Massacre, Mary Goose (Mother Goose) and many others.

AN HOUR'S DRIVE TO HISTORIC PLACES

These historic places we can visit in the short space of an hour's walk, and yet we have visited only a few of Boston's most interesting places. We certainly ought to see the Boston Navy Yard across the river in Charlestown, occupying over 120 acres and nearly a mile and a half of water line. Here is moored the U. S. Frigate "Constitution" ("Old Ironsides"), which was in forty engagements and never suffered defeat. She has recently been rebuilt and restored to her former condition by funds donated by the school children of America.

We certainly should also visit Faneuil Hall, the "Cradle of Liberty," with its historical paintings and portraits; the Old North Church, from the belfry of which were hung the lanterns as a signal for Paul Revere to start on his famous ride; the Paul Revere House, the oldest house in the City of Boston, built about 1660; all reached by a few minutes' ride from the Common.

By short motor trips we can go up the north shore through many typical New England towns and villages, some of which maintain the character of their Colonial days: Amesbury, the home of John Greenleaf Whittier; Magnolia with its Rafe's Chasm and the Reef of Norman's Woe; Marblehead with Willard's famous painting "The Spirit of 1776"; Newburyport, the birthplace of William Lloyd Garrison; Rockport with its old castle, claimed to have been built in 1640, and the Witch House on Granite Street; Salem with its House of Seven Gables, the Salem Witch House, and the Hawthorne home.

Along the southern shore we can visit Barnstable, the home of James Otis; Duxbury, the home of Elder Brewster, Miles Standish, John and Priscilla Alden; Eastham, where the first Indian was killed in an encounter between the Indians and the Pilgrims; Kingston, where a huge boulder marks the site of the home of William Bradford, the first Pilgrim governor; Marshfield, the site of Daniel Webster's home and burial place; Plymouth with its famous Plymouth Rock; Provincetown, where Peregrine White is buried, the first white child born in America; and Scituate; where hangs the Old Oaken Bucket.

To the west lies Concord, with its Antiquarian House, a brick building of early American type designed to show inside and out

the rambling growth of an old New England homestead, and displaying furnishings of authentic local design which have been preserved in such quantity that they show many aspects of the lives of our forefathers. Here also are the homes of Ralph Waldo Emerson, Nathaniel Hawthorne, Louisa M. Alcott, and here the

THE OLD STATE HOUSE

Here the General Court of Massachusetts met, and from its balcony was proclaimed the Declaration of Independence.

Courtesy of Boston Chamber of Commerce

famous Sleepy Hollow Cemetery where rest many of Concord's illustrious authors.

At Lexington is the Hancock-Clarke House, where John Hancock and Samuel Adams were staying when Paul Revere rode into town, warning of the approach of the British. The contents of this

house are of great historical interest, containing many objects illustrating the customs of early times.

On Lexington Green is the monument showing where sixty or seventy "Minute Men" hastily gathered to oppose the British regulars on the morning of April 19, 1775.

In Sudbury is "The Wayside Inn," originally named "Howe's Tavern," then "Red Horse Tavern," and deriving its present name from the fact that it is regarded as the scene of Longfellow's "Tales of a Wayside Inn."

On the Inn property is a coach house in which is the stage coach used in 1825 by General Lafayette on his way to lay the corner stone of Bunker Hill Monument; also the Red School House, referred to in the well-known poem "Mary had a little lamb."

I realize that this is just a mere catalogue-mention of a few of the hundreds of interesting places within less than an hour's drive from the convention headquarters. I am still more conscious of the fact that the places mentioned are associated entirely with Boston's past. It ought to be emphasized that Metropolitan Boston is a modern community of over two million inhabitants and as such contains places of as great modern interest as these are of historical interest. The convention committee has made every arrangement for you to visit and inspect to your heart's content scores of such places. Remain with us long enough to become acquainted with this part of New England. It's a duty you owe to yourself and to your grandchildren.

THE ODYSSEY OF THE ALUMNUS

By DEXTER S. KIMBALL

Dean, Emeritus, of the College of Engineering, Cornell University

To those of us who long have had the pleasure of living in a college community the never ending panorama of progress from freshman to senior and from newly-minted graduate to sedate alumnus is one of constant interest. Like Penelope of old, the university is always glad to see her many Ulysses return and give an account of their wanderings, to glory in their successes and sympathize with their troubles. And no doubt there is many an alumnus whose Odyssey has taken him to far-away places who feels like Ulysses of whom Cicero has remarked (so Professor Durham has told me) "that hero with all his wisdom would barter immortality itself for a sight of that old Ithaca perched like an eagle's nest high on the rocky cliffs." True when they do return they are apt to stir up almost as much of a disturbance as did their prototype of old. Many people, no doubt, think that these periodical eruptions and the noisy criticisms of the present day alumni are peculiar to this modern age. Nothing could be farther from the truth. College students and college alumni probably have not changed markedly in this respect since the foundation of Padua and Bologna.

The first modern alumnus of whom the writer has record was the famous Samuel Pepys whose Diary will ever remain one of the most interesting contributions to English literature. Born in London he graduated from Cambridge in 1653. Like many others his college record gave little indication of his future greatness. The single entry in the College Order Book concerning him states that he and his friend Hinde incurred a severe rebuke for being "scandalously overseene in drink." It is not to be inferred from this that Pepys wasted his time at Cambridge. His library contains books in Greek, Latin, French, Spanish and Italian. He played several musical instruments, sang and composed music. More important he developed an insatiable desire for knowledge. His keen observant mind was alive to beauty in every form, including the fair sex, and the many touching references in the Diary to little children mark him as a man of warm heart and fine sensibilities. His account of his subsequent visits to his Alma Mater and his

conversations with former classmates and faculty members reads marvelously like that of the alumnus of today.

Seven years after graduation he took his brother Tom to Cambridge to enter him as a student and while there was entertained by some of his former teachers at dinner, but he was much disappointed by the intellectual atmosphere of the place and complained that "in their discourse I could find that there was nothing at all left of the old preciseness in their discourse, especially on Saturday nights." Who has not heard the alumnus thus orate on the decadence of his college? It is firmly fixed in the mind of every old grad that his university began to go down hill immediately after the graduation of his class.

Two years later he records with great gusto attending a "Congregation" at the University for the purpose of electing certain officers. He says "Dr. Fairbrother . . . gets me a gown, cap and hood and carries me to the Schooles where Mr. Pepper my brother's tutor and this day chosen Proctor, did appoint me an M. A. to lead me into the Regent House where I sat with them and did vote by subscribing papers thus * 'Ego, Samuel Pepys eligo Magistratum Bernardum Skelton alterum e taxatoribus hujus Academiae in annum sequentem.' The like I did for one Biggs for the other Taxor and for other officers as the Vice-President for Mr. Pepper and which was the gentleman that did carry me into the Regent House." Here, indeed, we have the Alumni trustee in all his glory signing his name with a flourish and the heart of the reader of the Diary cannot but go out to him in his somewhat boyish delight at this intimate contact with his Alma Mater.

Fourteen years after graduation we find him again at Cambridge with his wife, maid and man servant. He is now Secretary of the Admiralty, something of a person, and the "town musique" serenades him, "but Lord what sad musique they made." And he records with pride taking his party to see the sights "and with much pleasure did this, they walking in their pretty morning gowns very handsome, and I proud to find myself in condition to do this; and so home to our lodging." Who has not seen the prosperous returning alumnus showing his wife and perhaps his children the scenes of the best four years of his unmarried life, telling them about beloved old Professor What's-his-name and the idiosyncrasies of old Professor Whosit and looking up those of the faculty with whom he had close contact and in general renewing his youth?

The next year he is back again on his way to visit relatives in that region and stays over-night in Cambridge at the Rose Inn.

* I Samuel Pepys choose Master Bernard Skelton as one of the tax assessors for the ensuing year.

But he did not sleep well and complains that he "lay very ill by reason of some drunken scholars making a noise all night." Aha! He is only 35 years of age but already he has forgotten having been haled before the faculty and his salad days are, he thinks, well behind him. He is slightly annoyed at student boisterousness and is becoming more sedate. Not all alumni reach this stage so early in life, indeed a few never outgrow a certain youthfulness that comes over them when they find themselves again in college precincts. As we shall see Pepys himself had not outgrown certain tendencies. For, shortly after he is again at Cambridge and states "I walked to Magdalene College and there into the buttereys as a stranger and there drank my bellyfull of their beer which pleased me as the best I ever drank; and hear the butler's man, who was son of Goody Mulliner over against the College that we used to buy stewed prunes of, talk concerning the College and persons in it, and find very few that were of my time. But I was mightily pleased to come in this condition and see and to ask."

He was now 15 years out of college and already found himself something of a stranger on his return. Who has not had this experience and like Pepys begun to realize that life is indeed brief and that there is nothing so constant, even around universities, as change both of men and things.

Like a good alumnus his interest in Cambridge deepened apparently with advancing years. When he was gathered to his fathers he bequeathed his library, the collecting of which afforded him so much delight, to the University. This collection, which includes the famous Diary, has been kept intact just as he left it, a fitting memorial to this unique alumnus. It is one of the most precious possessions of his Alma Mater and Cambridge can well be proud of the Odyssey of this Ulysses whom it once reprimanded for being "scandalously overseene in drink." For the pilgrim's benefit the spot where he sleeps in St. Olave's church in London is listed in all guide books with the many similar places where England has buried her great men. "And so to bed."

REPORT: PROGRESS IN ENGINEERING EDUCATION 1935–36

Society for the Promotion of Engineering Education

Note: This second annual Progress Report aspires to enrich the Society's archives by recording significant events, developments and trends in engineering education. A group of members of the S. P. E. E. were requested to report items regarded as significant and their replies form the principal basis of what follows. The report is selective and not exhaustive. The first report appeared in ENGINEERING EDUCATION, February, 1936.

THE ACCREDITING OF ENGINEERING CURRICULA

The year has witnessed the fruition of the long time and perplexing problem of accrediting in engineering education. Engineering schools have developed as individuals; each faculty has fixed its own curricula and set its own standard; the common bond has been voluntary association and discussion in S. P. E. E. What authority or power could overcome this spirit of "rugged individualism"? But during the past few years a way has been found. The professional societies, the educational group (S. P. E. E.) and the representatives of legal engineering licensure, united in Engineers' Council for Professional Development, have found a way to do what a decade ago seemed well nigh impossible.

The paper by Committee chairman Compton and discussion by Mr. Ferebee at the convention last June (Sept. '36, p. 64) * present the general situation. A detailed report of procedure and list of accredited curricula offered by some 35 colleges in Regions I and II (Maryland, Pennsylvania and the states to the Northeast) appeared in a sixteen-page Supplement to ENGINEERING EDUCATION (Oct. '36). Accrediting in other districts is scheduled for completion by the fall of 1937.

Another phase of accrediting is its "Spiritual Adjustment." A dean reports:

> The most significant event in our own school during the past year was the visit of the inspection committee of the E. C. P. D., and their subsequent suggestions. They brought to light in a friendly way points of weakness neglected or overlooked. Where we were good they commended us. Surely the visit and study of my institution by a representative and trustworthy committee of engineers and engineering educators has allowed me to appraise my institution with confidence and to strengthen any weak

* References are to the JOURNAL OF ENGINEERING EDUCATION.

links. Even had no accrediting taken place, the visit of the E. C. P. D. delegatory committee was well worth while.

To those institutions which have not yet been visited by E. C. P. D., let me say that you will have a friendly, helpful visit and not a survey by a group of carping critics.

A member of an inspection committee comments that while the attitude is friendly the inspection is far from being formal and casual; it is searching and exhaustive and "very critical."

New Trend in the Society's Meetings

Something has happened to our annual conventions. For many years they have been the outstanding activity of the Society through papers, reports, discussions and after-meeting intermingling. Attendance and programs have changed. The average attendance at the last three conventions approximated 1000, about double the prior five-year average, although membership has increased only 10 per cent. A new feature now dominates the program—conferences by a score and more of organized and vigorous groups. At the 1936 Convention most of them held three to five sessions, several having more than a dozen items—papers, symposiums, discussions, demonstrations. About 400, a sixth of our members, participated. The trend toward the scientific and technological is pointed out by President Hammond (Sept. '36, p. 5) and accepted, provided the educational aspects hold a prominent place; also individual freedom of groups is commended, provided there is reasonable coördination. New men, young men, are alert and assuming leadership.

There are now nearly a score of geographical Sections (Nov. '36, p. 138), including up to 17 institutions, which usually hold a meeting of one or two days annually. Attendance reaches several hundred; zest and quality are high. And there are nearly a dozen individual schools with Branches.

All these voluntary activities attest a new vitality in engineering education.

The Keynote of 1936 Convention

Sentiments in S. P. E. E. 1935 addresses and papers by Presidents Williams and Walters and Professor Jackson were crystallized by our President Anderson into the Keynote for the Wisconsin convention, "The Spiritual Adjustment of the Student." How can the school aid in developing character and personality so essential in the career of the engineer? The Secretary reports program difficulty as so many "desired to present papers on this topic." There were pertinent papers by President Anderson (Sept. '36, p. 9), Governor La Follette (Sept. '36, p. 27), Professor Mead (Sept. '36, p. 31),

General Rees (Sept. '36, p. 37), President Gaines (Nov. '36, p. 171), Dean Kimball (Nov. '36, p. 180), Dean Sackett (Nov. '36, p. 187) Professor French (Nov. '36, p. 193).

President Walters (University of Cincinnati) upon request gives his over-all impression of the Keynote and the responses:

A look backward at the Wisconsin meeting of the Society for the Promotion of Engineering Education is in truth a look ahead. For the theme of the program, the spiritual aspect of engineering leads less to reflection about the past than to contemplation about the future.

As to the future, what can the profession of engineering do on the spiritual side? Because it has so often been used vaguely or as cant, some of us are dubious about the very word *spiritual*. I like the interpretation of John Galsworthy, who shared this distrust, when he associated spiritual beauty with "a higher and wider conception of the dignity of human life."

But an enlarged spiritual vision is essential. We must have a conception of the dignity of human life that takes in not merely the few but the many, that strives to bring health and beauty and a high code of conduct within the reach of all. Beyond this there is, of course, a beauty in the theological realm into which engineering as such cannot go. Engineering can have its spiritual aspect in the deeply religious sense which Jesus taught and exemplified when He said that whosoever would be greatest should be servant of all.

Society Publications

Accompanying this enormous increase in papers and discussions there is no appreciable increase in the number of printed papers. The editor's desk has a pile of a hundred or more MSS, whose contents he cannot broadcast. Conferences and Sections are producing fresh and vital material. Must it go to the wastebasket? Is it possible for professors to put on one page (*a la* Reader's Digest) what they usually spread over three or four? If we forego our present 10 per cent reduction in dues our Journals might be 15 per cent or 20 per cent larger. If dues were increased a cent a day our pages might be doubled.

The report of the conference on Sections and Branches contains statistical information and an admirable map showing section boundaries. The nearest approach to objectives and methods and constructive suggestions is the sentence, "We were fortunate in having the inspiration of Dean Seaton's presence, which gave us the benefit of his wealth of experience in this work" (Nov. '36, p. 138). But those who were not there get none of it; if space were available the best feature would not be eliminated. Similar comment could be made on other reports.

Progress in publication is needed to amplify the progress elsewhere by interchanging ideas that now are unable to circulate.

Report on Graduate Study

The extensive study of graduate work in engineering that the Society had in progress under committees from 1932 to 1936, inclusive, H. P. Hammond, Chairman, was brought to completion during the latter years and was reported upon as a completed undertaking at the Madison meeting. Eight papers were presented (Oct. '36, pp. 87–105). The final report issued by the U. S. Office of Education under the joint sponsorship of that office and of the Society appeared as Bulletin 1936, No. 8, in December. Its 113 pages include such topics as historical development, present status, administration, teaching staff, general program, coöperative and part-time work, scholarships and fellowships, improvement, industry and advanced graduates, and summary of survey by S. P. E. E. It is for sale by the Superintendent of Documents, Washington, D. C., Price 15 cents. A new committee has now been organized to carry forward the consideration and discussion of various aspects and problems of graduate work.

A challenging article on graduate study has been presented by Dean Holbrook (Jan. '37, p. 435).

Engineers' Council for Professional Development

The Committee on Student Selection and Guidance, R. L. Sackett, Chairman, reports increased interest in organized guidance for high school students who are interested in engineering education. Committees of professional engineers are being formed. A manual of suggestions has been prepared to use with "Engineering, a Career, a Culture," a pamphlet prepared through the Engineering Foundation. Tests conducted in mathematics of 1900 students in September and October, 1934, show a correlation of test scores in mathematics with the average grade in all subjects of the freshman year of above .50, and for the first 2 years also, which would seem to indicate that the Coöperative Test in Mathematics prepared under Dr. Ben Wood for the American Council on Education has considerable selective value. The Coöperative Test in English was also given to the same students, but the correlation is less than .40.

An average loss of 16.5 per cent before the opening of the sophomore year was found. This compares with nearly 40 per cent reported in the Investigation of Engineering Education in 1924–26, pages 202 and 1069. While this indicates considerable improvement in guidance, orientation and aptitude, it remains true that the students who withdrew exceed those dropped for poor scholarship. The reasons given indicate an opportunity for a still greater effectiveness in our guidance and selection procedure.

The Committe on Engineering Schools, Karl T. Compton, Chairman, has been engaged in accrediting, as noted at the beginning of this report.

The Committe on Professional Training, R. I. Rees, Chairman, has as its objective the maturing of junior engineers. The present activities are as follows: The personal analysis blank; surveys of education facilities; objectives for future independent reading; general requirements for professional recognition; technical bibliography; procedures by which local engineering organizations may aid junior engineers.

The important after-graduation period has been generally neglected. Some industries provided training courses but the professional societies did little until the present effort of E. C. P. D. The activities initiated by the juniors themselves under the auspices of the Providence Engineering Society is typical of the work being undertaken.

General Rees, past president of S. P. E. E., was proposing to devote full time to E. C. P. D. activities, particularly the organization of local groups of junior engineers. He was on his first trip for this purpose when his death occurred in November (Dec. '36, p. 338). This work was considered by General Rees to be an opportunity of realizing his great vision of the development of the young engineer. These ideals underlie his paper of last June "Maturing the Engineer" (Sept. '36, p. 37).

The Committee on Professional Recognition, C. N. Lauer, Chairman, presents a comprehensive plan of coördination of the various methods of formal recognition of the development of an engineer, including college degrees, licensure as a professional engineer by the state, membership in a professional engineering society. The plan awaits action at a future meeting of Council.

Enrollment Gains; Finances Lag

The year 1935–36 marked the end of decline in enrollment of engineering students that began in 1932 and also a resumption of gain in undergraduate enrollment. For the current year—1936–37—a pronounced increase in freshmen substantiates the predictions based on returning industrial activity. In the graduate field incomplete statistics indicate a small increase.

There has not been a return to normal financial conditions. Substantial—in some cases very drastic—curtailment of income effected from 1932 to 1935, has continued. In the privately endowed institutions complete losses of some investments and curtailed earnings of others have caused loss of revenue in some cases of dangerous magnitude. In the publicly supported institutions

reduced appropriations continue to be the rule, with few exceptions. Increased attendance has not been so serious where there are substantial tuition fees but where they are small or merely nominal the result is serious and in some instances approaches the diastrous.

Items re the 1936 Convention at Wisconsin

The keynote of the meeting and major comment appear at the beginning of this Report. To make adequate record of a program of nearly 200 items is not the function of this report—they are listed in the yellow "Final Program." Summary reports averaging 2½ pages and covering 14 of the two dozen conferences have been published (Oct. '36, pp. 106–139) in addition to the report of the Conference on Graduate Studies (Oct. '36, pp. 87–105). And there are others.

The following items are those reported by members as significant.

Drawing.—A conference of teachers of drawing was held during several days preceding the convention. The goodly attendance, the constructive program and the enthusiastic attitude contributed to make the project an outstanding event.

Summer School for Teachers of Economics to Engineering Students.—With coöperation of Stevens Institute of Technology a session for teachers of economics to engineering students was held by the Society at the Stevens Engineering Camp, Johnsonburg, New Jersey, from June 28 to July 5, 1936. O. W. Eshbach, chairman of the Society's committee, and W. D. Ennis, of Stevens, supervised the session. Simultaneously Stevens alumni met at the Camp for study and discussion of industrial aspects of economic theory and practice. The sessions were attended by 39 S. P. E. E. members and by 38 engineering alumni. The S. P. E. E. session included two principal parts: (1) a short course of lectures on economic theory; and (2) evening lectures by prominent economists and industrialists on current economic problems. The session was deemed highly successful by those who attended.

Industrial Engineering received more than usual attention. The question debated was whether elective courses in personnel and management were sufficient, or is a curriculum desirable with elective subjects for those not taking industrial engineering. The acceptance by the E. C. P. D. Committee on Accrediting Engineering Curricula has given sanction to the title "Industrial Engineering" which recognition may lead to an increase in such curricula.

Economics.—There is evidence of a tendency to limit traditional economics to one semester and to supplement it by applications of economic principles to engineering problems. There is an oppor-

tunity for a fresh text on the subject of industrial economics, or a revision of books on similar subjects.

Engineering Economy.—"The chairman for several years of the informal joint conferences on the teaching of engineering economy, notes increasing interest in this problem. A new committee has been formally authorized. There are few problems that deserve as much attention from the general membership of the Society."

Demonstration interviews before a large audience were conducted by several industrial personnel men; students were interviewed; discussion and explanation followed. It was a revealing exhibition; simple questions could be manipulated to indicate major traits.

Conferences a Schedule Problem.—The increase in conferences was an event of the year; it led to the record-breaking attendance at Madison. The scheduling of these conferences so as to hold the maximum number with least confusion is a major problem. A committee has the matter in hand and will receive communications through its Secretary, F. L. Plummer, of Case School (Nov. '36, p. 169).

Potpouri

Graduates in Industry.—The excellent report of the Progress Committee in the February 1936 Journal has established it as worth while and should be made permanent. Last year's report said "Openings for recent graduates are to a large extent found outside of the normal (1929) channels. Small industries find college trained engineers useful." Manufacturing concerns in Virginia who previously had not employed engineering graduates are now finding them very desirable members of their organizations. It looks as though good men available in June 1937 will be fewer than the jobs available.

Industrial Demands.—The much increased demand for engineering graduates in industry and the seeming shift of emphasis in requirements to more generalized education are significant. Some industries apparently hope virtually to supply their accumulated deficiency in skilled labor from college classes.

Engineering Physics.—Perhaps the increased interest in curricula in engineering physics manifested at certain national conventions might be mentioned as indicating the need of applied physics not now incorporated in any of the standard engineering curricula. A paper presented at the Physics conference at Madison deals with Experience in Training the Engineer-Physicist (Dec. '36, p. 308).

Soil Mechanics.—Notable progress has been made in the development of studies in soil mechanics. This is evidenced by the formation of a new major Division of the A. S. C. E. devoted to this subject and also by the formation of a major Committee of the A. S. T. M. with a large number of sub-committees to study this subject.

Welding in the construction field is gradually increasing, standard specifications for the design and construction of welded bridges having been developed during the past year.

Isolated items might be mentioned: such as the attention by the President of the United States to engineering education in a letter addressed to administrative officers (Dec. '36, p. 285); the issue of the first partial list of accredited schools by E. C. P. D.; the noticeable recession of interest in highway engineering as measured by space in periodicals; the conference on soil mechanics at Harvard; and the large number of relocations of professors of engineering.

Lamme Medal.—The 9th award by the Society was made to Dean Herman Schneider, who inaugurated the Coöperative Plan in Engineering Education (Sept. '36, p. 2).

Three basic aspects of every engineering project are: 1. Technical, 2. Economic, 3. Social. Education should include the basic facts and principles of all three. At present the terms "Economics" and "Sociology" are too umbrella-like in their spread. The modern trend in engineering education is the recognition of these three basic fields of thinking and training, and the endeavor to gather teaching material and teaching methods which will form as firm a basis for the economic and social advance of the engineer as the technical sciences afford for advancement in the technical field.

S. P. E. E. Finances.—The annual report of the Treasurer (Sept. '36, p. 58) shows an operating profit for the year and a comfortable surplus. The report of the Secretary (Sept. '36, p. 61) records many items of interest and progress; notably the peak of membership, 2406 individuals and 121 institutions.

Engineering Enrollment.—Last year's report gave the approximate freshmen as follows: 1930, 25,000; 1932, 17,000; 1935, 20,000. Now may be added 1936 (Dec. '36, p. 366) 23,000.

	1929	1936	Change
Mechanical	27%	32%	+ 5%
Chemical	16%	26%	+10%
Electrical	34%	24%	−10%
Civil	23%	18%	− 5%
	100%	100%	

The Distribution of Freshmen among the four principal courses is significant; data are given for 1929 and 1936 (Dec. '36, p. 336).

In 1929 chemical was the smallest group, equal to 70 per cent of the civil; in 1936 civil is the smallest equal to 70 per cent of the chemical. The oldest branch yields to the newest. Electrical has dropped from first to third place. Chemical has climbed from lowest to second place. The 1929 data are from Vol. II, page 1166, of the Report of the Investigation of Engineering Education.

Committee, 1935–36 Report,
M. L. ENGER,
E. A. HOLBROOK,
R. H. FERNALD,
A. H. WHITE,
CHAS. F. SCOTT, *Chairman*

NOTE

Members who have read the foregoing report are asked to send their comment to Secretary Bishop—Does it add a worthwhile picture to "the panorama of the unfolding years" for the future reader? Does it give a convenient summary to the present reader? What items would you omit? What would you condense? What would you add?

CONFERENCE ON PROFESSIONAL STATUS AND EMPLOYMENT OF ENGINEERING GRADUATES *

By JOHN R. BANGS, JR.

Cornell University, *Chairman*

PROFESSOR BANGS: For some time there has been an increasing interest in the problem of bridging the gap between College and Industry. This interest reached a high-water mark last year at the Georgia meeting of this Society, and as a result your Committee on the Professional Status and Employment of Engineering Graduates was asked to continue its studies and to present its findings at this meeting. The idea was suggested that perhaps we might find a more vivid manner of presenting to you some of the problems concerned with inducting the college man into industry. We believe we have found such a way, and in our demonstration here this afternoon we are going to let you act as both judge and jury.

The committee in its investigations soon came to the realization that the focal point of the whole problem was the interview itself—that occasion when the employer and his student applicant actually meet face to face and discuss their problems on mutual grounds. What, then, could be more logical than actually to bring together a representative from industry and a student applying for an engineering position with that industry? Reasoning thus, we planned three interviews for this afternoon. We hope that these demonstrations, by bringing to life before your very eyes this most important of procedures, will present the problem to you with greater clarity and make you more fully aware of its many difficulties.

So far as I have been able to discover, demonstrations of this sort have grown out of three closely related fields. The first field is that of teaching Industrial Relations, Human Relations, or "Humanics" as an integral part of the engineering curriculum. The second field is that of industry itself. The third has grown about those courses which make a serious attempt to aid the graduate engineer in bridging the gap between college and industry. Industry and the colleges have a great community of interest in this problem; the former uses the demonstration method in training its junior executives, the latter uses it in helping its graduates obtain positions leading to the junior executive rank. I believe the first of

* Conference held in connection with 44th Annual Meeting, S. P. E. E., University of Wisconsin, June 23–26, 1936.

these fields, that of teaching Industrial Relations or Human Relations in engineering colleges, has exercised the greatest influence.

Early in 1928 Dean Dexter S. Kimball, coöperating with Mr. Sam A. Lewisohn, called a meeting of educators at the latter's home in New York City. As a result of this meeting and others, this Society in June 1929 appointed a committee on "Instruction in Industrial Relations." After careful investigation the committee came to the conclusion that this subject was of such importance that a thorough study of the possibilities, aims, and methods of teaching engineering students to manage men should be made during the year, and the result of the study submitted to the meeting of the Society at Montreal in June 1930. To carry out this purpose, the committee elected to its membership Professor Smith, requesting him to head this study and to put its conclusions in the form of a report. When Professor Smith presented the report on "Teaching Engineers to Manage Men" at Montreal, he told of a number of dramatic cases that he used with his students. The methods interested Mr. Lewisohn and General Rees, who were particularly interested in classroom demonstrations where students actually handled human relations problems. At their suggestion a case demonstration was put on under the direction of Professor Smith at another meeting held at Mr. Lewisohn's home, March 28, 1931. Since it was my privilege to attend both of the Lewisohn meetings, I became acquainted with the demonstration method relatively early in its application.

At this second Lewisohn meeting Professor Smith explained that the method of teaching by the actual handling of human relations problems in class, was developed in teaching junior executives in industry. In his judgment it was the simplest and most effective means of conveying a true understanding of human relations into the hearts as well as into the heads of these young men. He explained how, when he began teaching, he again found this plan of demonstrating human relations problems the simplest and most effective way of accomplishing the desired end. The actual handling of cases in class is only an element in the general method. It is done simply to carry the discussion of problems into the more difficult and realistic realm of action.

Initiated in this manner by Professor Smith, the demonstration method of teaching has been taken up by educators in several universities. Professor F. Alexander Magoun of Massachusetts Institute of Technology is one of its leading proponents, and he has made valuable contributions in the actual technique of carrying through these demonstrations. In addition to the work of Smith and Magoun, pioneer work in this field has also been done by Professor Schell at Massachusetts Institute of Technology, Professor Feldman of Dartmouth, Dr. J. E. Walters of Purdue, and Professor M. A. Lee of Cornell.

In the meantime a similar development had been taking place in another field. College recruiting officers, brought together through various personnel and management organizations, were seeking to shed light upon some of the intricate problems of inducting the college man into industry. At one such meeting of industrialists held at the Hotel Pennsylvania in New York City about 1928, Mr. J. H. Bigelow of the New York Telephone Company and Mr. C. S. Coler of the Westinghouse Electric & Manufacturing Company, staged an interview purporting to show the methods used in hiring college graduates. Their purpose was the same as Professor Smith's—to vitalize the proceedings and to stimulate the audience to participate in the discussion that followed.

To me, as a college personnel officer, this method appealed rather strongly, as I am sure it appealed also to my colleagues at other institutions. The result was that this type of demonstration came into use as a part of the work of bridging the gap between the senior year in college and industry. Mr. H. L. Davis, of the New York Telephone Company, has given such a course at Cornell University for the past five years; one of the high lights of his series of lectures is an employment demonstration.

I want to point out frankly to you that this method, no matter how well it may sound, has its dangers. One of my good friends from industry remarked to me that our demonstrations were slated for failure. In his experience, he explained, good could come from such demonstrations only if each part had been carefully rehearsed. I hope he is not entirely correct in his view. No portion of this program has been rehearsed.

The first interview will be conducted by Mr. M. M. Boring, of the General Electric Company, with Mr. C. J. Halamka, of the University of Wisconsin.

MR. BORING (To applicant): I am glad to know you, I am sure. Pull up your chair. You are taking chemical engineering?

MR. HALAMKA: Yes, sir.

MR. BORING: Graduating this year?

MR. HALAMKA: I am graduating after the end of the summer session.

MR. BORING: Why then?

MR. HALAMKA: I am taking some courses in chemical engineering. I couldn't take them last summer, which is the usual time, because of my activities in the R. O. T. C.

MR. BORING: That is a requirement of the summer course, is it?

MR. HALAMKA: Yes.

MR. BORING: I see. You say you have earned your way through school. How have you done that?

MR. HALAMKA: Well, mostly by saving previous to coming to school, about three or four years, beginning with caddying on the golf course, and during school I waited on table and worked as assistant in the engineering library. And I took care of rooms and did other odd jobs.

MR. BORING: You stayed out of school a year, did you?

MR. HALAMKA: No. I stayed out only one semester.

MR. BORING: You have taken longer in school. Normally you would have graduated with last year's class. I believe 22 is the average age. Where did you get the idea of chemical engineering? What was back of it? Your father is a shoemaker. Where does engineering come into that? What gave you the thought?

MR. HALAMKA: When I was a senior at high school I was very much interested in chemistry, and at that time I decided to go in for chemistry in the university. My brother was taking a course in electrical engineering at that time, and I asked him for advice and he said that engineering would be more practical than a straight chemistry course. I thought it over, gave it more consideration, and did think that chemical engineering would be better for me.

MR. BORING: This did not originate in your own mind. It was at the suggestion of your brother originally, was it not?

MR. HALAMKA: Well, partly, yes.

MR. BORING: You are satisfied now you did the right thing?

MR. HALAMKA: I am.

MR. BORING: Is there any particular type of work you want to do? What are your plans for the future?

MR. HALAMKA: My plans immediately are to go to school.

MR. BORING: You are looking for graduate work?

MR. HALAMKA: I have a fellowship in chemical engineering at the University of Wisconsin.

MR. BORING: Fine! That is because you have done rather a good job scholastically?

MR. HALAMKA: Rather.

MR. BORING: Standing in the upper quarter of your class. You made some records in your junior or sophomore year, did you?

MR. HALAMKA: Yes, I was quite good in mathematics.

MR. BORING: Flunk anything there?

MR. HALAMKA: No.

MR. BORING: That is too bad. What have you done socially? Have you picked out a nice-looking co-ed for yourself?

MR. HALAMKA: Yes.

MR. BORING: Good. She is in the university, is she? Living here?

MR. HALAMKA: She is not going to the university now.

MR. BORING: She has some time in the past?

MR. HALAMKA: Yes.

MR. BORING: You expect her to complete her work here, or has she finished?

MR. HALAMKA: She is an attendant in the Mendora Hospital.

MR. BORING: What do you do for recreation? All golf, is it?

MR. HALAMKA: No, it used to be but that is too expensive now.

MR. BORING: I see. I have to talk a little directly to you.

MR. HALAMKA: Yes.

MR. BORING: What do you read?

MR. HALAMKA: A little of everything. Well, in the last few years I haven't had time to really read, except chemical literature and other engineering literature that I have drawn from the library.

MR. BORING: You had economics?

MR. HALAMKA: No.

MR. BORING: You will get that, will you?

MR. HALAMKA: Outside of what I had in high school I don't believe I will be getting any economics.

MR. BORING: Going back now, you said you were interested in graduate work. Is it your thought that you want to get into something special in chemistry fifteen years from now?

MR. HALAMKA: Well, I have not thought that far ahead.

MR. BORING: Your plan is not all complete, then, for the future. You hope to go on out and hope to get a job when you graduate so you can take the girl with you? Do you care where you go?

MR. HALAMKA: No.

MR. BORING: Suppose you were sent to China as a salesman? Would you go out there?

MR. HALAMKA: I think it would be all right.

MR. BORING: Do you think you would really care for that sort of thing?

MR. HALAMKA: Well, except that sales work isn't —.

MR. BORING: You back down a little bit on that, would you?

MR. HALAMKA: Yes, just a little bit.

MR. BORING: You have no hobbies at all?

MR. HALAMKA: Well, there are a lot of things I would like to be interested in. I really don't have time to do them.

MR. BORING: Do you ever get to a dance?

MR. HALAMKA: Well, not very often.

MR. BORING: But you do dance?

MR. HALAMKA: Yes.

MR. BORING: Play any musical instrument?

MR. HALAMKA: No.

MR. BORING: You like to listen to music?

MR. HALAMKA: Yes.

MR. BORING: Have you any artistic talent of any kind?

MR. HALAMKA: I used to be pretty good in drawing.

MR. BORING: You get out and raise hell a bit once in a while?

MR. HALAMKA: Not often, but once in a while.

MR. BORING: What have you done on the "Wisconsin Engineer"?

MR. HALAMKA: I did not do very much. I was there in my freshman year, helping out in the office. I dropped out of that at the end of my sophomore year when I was really busy.

MR. BORING: Do you work at all with your hands?

MR. HALAMKA: Some.

MR. BORING: Rather good at mechanics?

MR. HALAMKA: Yes.

MR. BORING: Do you work outside? Do you have time for that?

MR. HALAMKA: No, just golf. I was out picking strawberries.

MR. BORING: You are actually sure, now, that you are taking the right sort of program, and you want some kind of technical work. I take it from that that you are going to be quite satisfied to sit at a desk inside working with a slide rule, working in mathematics, working out problems, in the future?

MR. HALAMKA: Yes.

MR. BORING: Still you can make friends easily, can you?

MR. HALAMKA: Yes.

MR. BORING: Do you enjoy this set-up that we have here, talking in public?

MR. HALAMKA: I am not very nervous.

MR. BORING: Do you realize that is going to be part of the job though, that you have to get up and make talks and so forth in the future?

MR. HALAMKA: I have had experience on the stage before.

MR. BORING: Have you thought at all of changing schools?

MR. HALAMKA: Well, I think that a change of school would be a good thing, in a way, in that it would give a new background and different conditions.

MR. BORING: Of course, with the set-up on the fellowship it is naturally the proper thing to go right on here?

MR. HALAMKA: Yes.

MR. BORING: Are there any questions you would like to ask me?

MR. HALAMKA: Well, I know G. E. is the biggest company and has room for many engineers. That is the aim of practically all electrical engineers, to get in with G. E. They consider it a good place. But I know, too, that there is room for chemical engineers in your corporation.

MR. BORING: Did you try to find a chemical engineering job before you graduated?

MR. HALAMKA: Before I graduated?

MR. BORING: Yes, this spring when the interviewers were out.

MR. HALAMKA: I have been interviewed. I have been to several but I have not been successful.

MR. BORING: Do you think you really tried, though? Would you rather have done that than to go on to graduate work, do you think?

MR. HALAMKA: I think that going to school would be preferable.

MR. BORING: That would be preferable? Clear to the doctorate?

MR. HALAMKA: Well, not that far ahead.

MR. BORING: You think it should be one year for your master's degree and then you will go out and work?

MR. HALAMKA: Depending upon how far I get next year.

MR. BORING: How are you going to feel if some industrial fellow comes along and says, "Here is a good job that is not chemical engineering," say a mechanical job? You would be satisfied with that?

MR. HALAMKA: I have trained for no mechanical engineering.

MR. BORING: Oh, yes, you have. You had mathematics. Do you read the daily papers?

MR. HALAMKA: Practically every night.

MR. BORING: Practically? Pretty well through it?

MR. HALAMKA: Well, I do not get very far.

MR. BORING: Do you read the financial pages?

MR. HALAMKA: No.

MR. BORING: You do not care for that, not much interested in that?

MR. HALAMKA: Well, I think the trouble is I do not understand it.

MR. BORING: You appreciate, though, that you are going to have to think of money in future jobs, that you do cost something?

MR. HALAMKA: Yes.

MR. BORING: And everything you make costs something. Not afraid of hard work?

MR. HALAMKA: No.

MR. BORING: You would not be bothered if we gave you a pick and shovel and started you in on that?

MR. HALAMKA: No.

MR. BORING: You would rather have chemical engineering before you take on that job, would you?

MR. HALAMKA: Yes.

MR. BORING: Is there anything else you would like? I grant you realize there is a place for chemical engineers, but it must be very indefinite. Suppose I said to you, "Yes, here is a job." Knowing as little as you do about it, would you be willing to accept such a job?

MR. HALAMKA: Well, I think the G. E. Company is a big enough corporation and there is enough room for advancement that if I did

get in some place, if I worked hard and showed improvement I might be able to get ahead in the company.

MR. BORING: You are an only child in the family?

MR. HALAMKA: I am the middle.

MR. BORING: You are the middle?

MR. HALAMKA: Yes.

MR. BORING: You have a brother older than you are? Some brothers, have you?

MR. HALAMKA: Yes.

MR. BORING: None of them are engineers, though?

MR. HALAMKA: Not yet.

MR. BORING: Some are going to take it?

MR. HALAMKA: My brother was a graduate of electrical engineering. He has a job but it is not electrical engineering.

MR. BORING: One of these fellows who makes a mechanical engineer out of an electrical engineer. Your people were born in the old country, were they?

MR. HALAMKA: Yes.

MR. BORING: Grandparents and on back?

MR. HALAMKA: Yes.

MR. BORING: You are of second generation stock?

MR. HALAMKA: Yes.

MR. BORING: That hasn't brought about any real interest in foreign work? You said you might like China.

MR. HALAMKA: No.

MR. BORING: In other words, where there is a good job you would be willing to go and would be satisfied. You believe you could make good in almost any location?

MR. HALAMKA: Yes.

MR. BORING: And your young woman would be willing to go with you?

MR. HALAMKA: Yes.

MR. BORING: Well, I think I have enough detail on the thing that I need. You are going on for graduate work this year. I hope that you will stop in and see me before you graduate next spring. I would be very much interested in talking details with you. You can keep in touch with me through the electrical and mechanical departments here. We will see what we can get together on in the spring. You are not ready at the present time. Thank you.

MR. HALAMKA: Thank you, very much.

In the next group, the interviewer is Mr. Hobart S. Johnson, President of the Gisholt Machine Company, of Madison, Wisconsin, who will interview Leo S. Nikora of the University of Wisconsin.

MR. JOHNSON: It has been the practice of our company for a good many years to have graduate engineer applicants interviewed

by two or three of the officers of the company. Of course, that would be impossible with concerns like the G. E. Company, the Telephone Company, and so on, but our concern being so much smaller, the officers keep a very close track of these applicants and their progress in the concern at a later time. I am only conducting the one interview, of course, this afternoon. The candidate would be passed on to others after I finish, or I might be the last one of the interviewers.

Mr. Nikora, I am glad to meet you. We have not your application, but I understand you are from Milwaukee. (It is quite immaterial whether the application is made prior to this interview or after the interview.) I should like to ask, how it happens that you are making an application with us.

MR. NIKORA: Well, I heard about your company and products at Wisconsin University.

MR. JOHNSON: I can perhaps treat it a little locally. You walked by our plant occasionally, or you have driven by the plant, it is perhaps more to the point to say?

MR. NIKORA: Yes.

MR. JOHNSON: Do you know what we make?

MR. NIKORA: You make turret lathes and automatic lathes, and I am quite interested in some of the dynamic balancing machines that you have there.

MR. JOHNSON: I see. Do you know anything about our competitors, who they are or where they are located?

MR. NIKORA: Well, you manufacture several types of equipment and therefore you wouldn't have one competitor for the whole line, but I think that one of your competitors is located in Cleveland, making lathes, and there is one in Vermont making tools, automatic lathes.

MR. JOHNSON: That is right. I presume you are a reader of the mechanical papers?

MR. NIKORA: Yes, sir. I subscribe to the Mechanical Engineering magazine.

MR. JOHNSON: Have you seen *The American Machinist*, or *Machinery*, or *Iron Age?*

MR. NIKORA: Well, I have glanced through some of those. I have read *Iron Age* considerably.

MR. JOHNSON: You have taken a four-year course here, a mechanical engineering course, as I understood.

MR. NIKORA: Yes.

MR. JOHNSON: Where you first got word of coming here?

MR. NIKORA: Yes.

MR. JOHNSON: Of course, you understand that we have three different problems in our business, one of design, one of manufacture

or production, and another of sales. Have you any inclination to follow any one of those particular directions?

MR. NIKORA: Well, I would be interested primarily in sales, because I should like to do something in advertising or technical journalism, and I also think that the field of production and production methods and control would interest me.

MR. JOHNSON: I see. Do you feel in your mind it would be quite a necessary thing for your experience and progress in the institution to have a very good fundamental factory training in the shop, practice, or whatever you might call it, to go out into the shop and run machines for a period of time, different classes of machines?

MR. NIKORA: Well, I feel that it would be good, but not so much from the point of learning how to use my hands because we have already had a good deal of shop work here, but I have never been under the strain of production.

MR. JOHNSON: I see.

MR. NIKORA: I think that would be interesting.

MR. JOHNSON: Do you not think it would be very useful in whatever line you followed in the institution to know pretty well what we made and how it was made, and wouldn't it make your control more valuable in selling or in any field, in business management or whatever it might be?

MR. NIKORA: Yes, that is true. I feel that way about it, too.

MR. JOHNSON: Would you be willing and rather anxious to go into the factory for a period of time?

MR. NIKORA: Well, since I said that I am interested I guess I have to say I would be wanting to do the work in the shop.

MR. JOHNSON: You are not afraid of getting your hands dirty for a couple of years?

MR. NIKORA: No.

MR. JOHNSON: Well, I think that your discipline there is very wise. In going through college, did you work your way through or were you partially assisted?

MR. NIKORA: I was partially assisted.

MR. JOHNSON: I see. What have you done during your vacation periods?

MR. NIKORA: I have not done very much, that is, not technically, just worked around the house. I have done some landscape work.

MR. JOHNSON: Have you sought jobs during the long vacation periods?

MR. NIKORA: I have, but it so happened that my vacations occurred when I couldn't get a job working.

MR. JOHNSON: I can understand that, all right. What activities in college have you been interested in?

MR. NIKORA: Well, I am very much interested in the Wisconsin Engineer magazine, and I am also on the board of the Polygon with relation to the activities of engineers in the school. And I am a member of the A. S. M. E., a student member. I have taken part in dramatics here with the Wisconsin Players. I have a considerable number of interests.

MR. JOHNSON: You are a member of A. S. M. E.?

MR. NIKORA: Yes.

MR. JOHNSON: Were you at the meeting which Mr. Ralph Landers addressed last fall?

MR. NIKORA: Yes, I was there.

MR. JOHNSON: As to your college ranking, which you do not need to answer. You would be asked a question whether you were in the first, second or third groups. Perhaps if there were no audience some of these questions might be still a little more intimate. So you feel that you would be entirely willing to go into our plant and work the regular working hours per day for whatever time would be deemed necessary on the part of the management or the particular man under whose direction you would be?

MR. NIKORA: Yes, I think I would.

MR. JOHNSON: Have you any questions you would like to ask me now?

MR. NIKORA: Yes.

MR. JOHNSON: Don't hesitate to ask me anything that is in your mind that I can answer without embarrassment, the same as yourself.

MR. NIKORA: Well, I should like to know if you have a definite wage scale. That is, you hire a man and tell him you pay him so much for ten months maybe, and then raise him. Do you watch your men closely enough and have you sufficient interest in them to increase their salaries as the work they do warrants?

MR. JOHNSON: We increase their salaries from entirely an individual standpoint, without any prescribed time of pay change, depending upon ability and the progress and effort and energy of the man.

MR. NIKORA: How many men do you have employed altogether in your shop?

MR. JOHNSON: We have about 600 at the present time.

MR. NIKORA: In the last ten years have you had any labor troubles?

MR. JOHNSON: I can tell you that we have not had any labor troubles since 1920. We had plenty of it for a short time before that time. However, the difficulty ended very happily and I think without any broken heads.

MR. NIKORA: The reason I asked that question I think is obvious. That is, if you have heard of companies that are having considerable trouble, it usually affects your choice to go with a concern of that nature.

MR. JOHNSON: I see. That is the standpoint from which you are asking me that question, is it?

MR. NIKORA: Yes. Do you publish a technical journal or a house organ of some sort?

MR. JOHNSON: We did have a house organ before 1930. We haven't had any since. We have not had very much to say until the past year and a half.

MR. NIKORA: I suppose one of the most important if not the most important thing concerns the wage rate. Of course, that is up to you again.

MR. JOHNSON: Well, we are starting in the young men, college graduates (I don't hesitate to make that statement in open meeting), at 50 cents an hour. That rate would be augmented as rapidly as a man, to our mind, is worthy of it. There is also in the factory an incentive system whereby in the course of a short time he can considerably augment that, very considerably augment it, if he has the ability and head and hands to do so. I will turn you over to one or two other of our officers who will talk to you. After that time we should like to have you put in your regular formal application, which covers a great many different questions, and then we will advise you if we would like to have a later interview with you.

The third demonstration is to be conducted by Mr. Howard L. Davis of the Bell System and Mr. H. C. Mayland.

MR. DAVIS: Sit down, please. Mr. Mayland, I have a very strong belief that people succeed in places where they are interested. Maybe we have some place in the Bell System in which you would be interested; maybe we have not. So in considering your interests let us not consider them just from the standpoint of any one organization, the Telephone Company, or any other.

My first question to you, therefore, would be: Have you any particular interest at all which is pulling a little stronger on your heart strings than anything else? You get through college here next February? I believe that is right. If you finished college next week could you say: "If I could get a job in some general line of work, I would rather have it than anything else"? Do not manufacture a reason for this because that would not help at all.

MR. MAYLAND: Well, the research laboratories in your organization, where you have research and development programs.

MR. DAVIS: That's right.

MR. MAYLAND: That is the line of work I am interested in at this moment. I really have been interested in it for a long time.

MR. DAVIS: What has led you to that feeling? What makes you feel that you would be more interested in research than you would be in manufacturing, some phase of manufacturing, manufacturing development work, or something of that nature?

MR. MAYLAND: Well, as far back as I can remember that has been my ambition, to get a job in research or development work. Since I have come to college here I have seen what it is like and it confirmed my ambition.

MR. DAVIS: My conception of research is looking for something that has not been discovered before. My understanding is that the Bell Laboratories has a very small group working on research, whereas the largest part of them are taking the products of research and every other known thing there is, every other tool that is being used, mechanical tools and otherwise, and developing something which will be useful in the Bell System or some by-products that come out. Is your interest primarily more in research, finally to get something new, cobalt-steel, some other new magnetic materials, or is it in taking the products of research and applying them to improvement in the system?

MR. MAYLAND: I am interested in taking the second step. I would rather put the products of research into production.

MR. DAVIS: Development work?

MR. MAYLAND: Yes.

MR. DAVIS: That is different from a pure researcher. We look upon him as someone who is interested in developing. Well, now, in what part of development do you think you would be most interested? I am merely trying to get your ideas. Something that pertains to chemical engineering, for example, development of resins, coatings for insulated wire, things along that line? Or more the manufacturing processes that you would go through to get these things?

MR MAYLAND: Yes.

MR. DAVIS: The processes such as you put the raw material through to get the products?

MR. MAYLAND: Yes.

MR. DAVIS: A good deal of that is done in the Western Electric Works. You would not care, then, particularly, whether you were in the laboratory or in the Western Electric development work?

MR. MAYLAND: I would rather be in the development laboratories, if you have such laboratories.

MR. DAVIS: Well, would you rather be in the laboratory where they are working for standards, where they are working in order to create these standards, to arrive at these standards? There may be special work on each individual case, establishing tolerances and establishing specifications to be followed. Would you rather

establish specifications or take those, after they have come through the laboratory, and apply them to quantity production in the factory, in development engineering work in the factory?

MR. MAYLAND: I would rather apply them to development production in the factory.

MR. DAVIS: We are sort of working over from the laboratory to the Western Electric, are we not?

MR. MAYLAND: Well, I would rather transfer the products of the laboratory to the factory, but I would not like to go into the factory.

MR. DAVIS: Do you mean in the factory itself on factory production? You would not want to go into factory production work?

MR. MAYLAND: That is right.

MR. DAVIS: How about being in the engineering development work of the factory, where they plan for and lay out the methods of getting the new development into quantity production?

MR. MAYLAND: I guess that is what we are talking about.

MR. DAVIS: That is in the factory but not on the production line?

MR. MAYLAND: I see. That is what I would like.

MR. DAVIS: We are now over in Western Electric, are we not?

MR. MAYLAND: Yes. That is down at Hawthorne, at Chicago?

MR. DAVIS: The main factory is at Hawthorne, and there is another factory in Kearny, New Jersey, and one at Point Breeze, Maryland, near Baltimore. Have you any particular preference for location at all?

MR. MAYLAND: It is not essential, but Chicago—I would like to go down there.

MR. DAVIS: You would?

MR. MAYLAND: I would.

MR. DAVIS: You prefer to be rather nearer home?

MR. MAYLAND: Yes.

MR. DAVIS: How many children are there in your family?

MR. MAYLAND: Four.

MR. DAVIS: There is not the same reason for you to stay right in your home community that there would be if you were an only child, is there?

MR. MAYLAND: No necessity at all.

MR. DAVIS: On preference, I have known other fellows who gave the reason they took jobs because they had a girl in the vicinity. Have you some girl there?

MR. MAYLAND: No girl.

MR. DAVIS: You would be open to reason later on?

MR. MAYLAND: Yes.

MR. DAVIS: Well, now, have you any questions you would like to ask me?

MR. MAYLAND: Have you positions open?

MR. DAVIS: We did have a very few positions open in the spring in manufacturing and in the laboratories. I believe they are filled now. What we may have by next February is another question. We are hoping that times are going to be better and better. There are indications that there will be enough additional demand for telephone service by next spring so that we can go ahead and expand our organization. The Western Electric has been putting on a few more men.

MR. MAYLAND: Just what kind of work would it be. I would like to know more about it, if I could get a job in the development, in the laboratory of the factory.

MR DAVIS: Well, you would go into the organization in the type of employment that would be agreed as being that in which probably you would find greater interest and greater satisfaction and for which your training and ability seem to fit you. You would get a general idea of the work of the company—a bit of orientation. Then you would be put on a definite job. You would be trained for that by being given information along the lines of work that you were going to do.

MR. MAYLAND: I would have to go through an orientation period?

MR. DAVIS: Do you mean before you actually get into the shop department, or on a production job? I do not mean just that. I meant it the other way. All jobs are at first more or less orientation jobs. A man must learn how to do something before he can do it and be trusted to carry it through. To that extent, yes. If you mean by an orientation job that you would be given work in some one department and then work in some other department in order that you might get a general picture of the organization, no. You would not get anything of that or much of that, not in these days, when so few are taken on. There are now more hired for work in certain departments that have definite work to be done. But of course you realize that when a college man is employed he is not employed to do just the work of to-day, but he is employed with a view to what he is going to be five or ten years in the future. He then is put on work which will train him to the point where he can do that work later on.

MR. MAYLAND: How many men do you have working, for example, in the Chicago plant?

MR. DAVIS: At Chicago, when the Hawthorne plant was working at full blast I believe there were around 40,000 or 45,000 people employed. I am not positive on that, but the organization is smaller to-day, naturally.

MR. MAYLAND: What percentage of that number would be engineers?

MR. DAVIS: I am not positive on that. We would have to go into that later. You see, to-day I am interviewing you for the Bell System, as Mr. Bangs said. Actually, I recruit primarily for the New York Telephone Company. Then as I run across a man who, in my estimation, would be well worthy of consideration by the Western Electric or Laboratories men, I give him what information I can. I then get him in contact with the Western Electric or the Laboratories people. Then they decide whether or not they have some opening for him. They give him more specific information. You realize there are changed conditions these days and the plants are operating on a restricted basis. I do not keep track from day to day of just what jobs open up here or there in other Bell System Companies. It is a small percentage, naturally. The engineers form a rather small percentage, I can say that.

MR. MAYLAND: Is there a great deal of conflict in such a large corporation?

MR. DAVIS: Conflict?

MR. MAYLAND: Well, how do they arrive at a basis for promotion when they have so many to choose from?

MR. DAVIS: Well, it is the work a man does, the spirit that he shows toward the job, the attitude that he has, his originality, and all of the other things which, in the judgment of the superiors, make him stand out as the type of man who is probably going to succeed in this business. And, if so, where? What type of work will he probably fit into best? How far will he probably go if he is promoted? Naturally, a great many of these judgments are matters of opinion; nothing mathematical about them.

MR. MAYLAND: Well, then, it is just what the man appears to be?

MR. DAVIS: No. There may be a point in what he appears to be, but it is also what he is and what he does.

MR. MAYLAND: Well, I guess I have no more questions.

MR. DAVIS: I am very glad to have met you. I will say this. There is here at this conference Mr. George B. Thomas who is the Personnel Director of the Bell Telephone Laboratories. I suggest that you find Mr. Thomas and have a little talk with him. Have an interview with him to have your fences erected and then keep them maintained until next February when you graduate. He may have something for you. He may find that he would like to have you in the organization, if he has room for you. I am very happy to have met you. Good-bye.

PROFESSOR BANGS: The important question arises now: What did you learn from these interviews?

H. S. ROGERS (Brooklyn Polytechnic Institute): I have wondered whether the interviewers had the academic records of the boys, and if they had their personnel cards before they interviewed the boys. Was that so?

PROFESSOR BANGS: In the case of Mr. Davis and Mr. Boring, they had the interview blanks, which are filled out preliminary to the interview. It merely cuts down the time for asking questions. In the case of Mr. Johnson, there was no interview blank.

DR. ROGERS: You think those interviewers can get that information?

PROFESSOR BANGS: They get that information, yes. In college interviewing the work takes various forms. The industrial representatives may receive just the interview blank, or they may receive the interview blank in addition to a lot of information which the college personnel office would provide.

DR. ROGERS: Of course, the things which are observable in the interviews, if they are to be discussed here in an impersonal manner, include the point that the young men seem to lack a definite knowledge of the organization of industry and the types of work that are available in industry. Their questions were pointed to some extent but they showed a lack of understanding that certainly proved there was no coaching for the interviews this afternoon. I had presumed that the men who interviewed students throughout our institutions had more definitely jobs in mind in which the students were to be placed.

DEAN A. A. POTTER (Purdue University) I have contended for many years that interviewers in general spent two or three minutes to find out what they really can about those students, as compared with the personnel departments or particularly some of the professors who come in contact with them. I am quite convinced that in the case of some of the organizations (I won't pick out any particular one) Dr. Walters, or any of the professors in Purdue, does a very much better job. Of course, the personal interview can find out if the individual is deaf or blind or has some type of infirmity. I am convinced that a company would save itself a great deal of trouble and expense if they would rely upon those of us who have complete records, and who know students and take our word for it.

DEAN R. L. SACKETT (Pennsylvania State College): A number of things that I thought of saying have melted away. I was interested in the different approaches of the three gentlemen to this same problem. That led me to conclude that the particular purpose which they had in mind was the assay of the individual, of the person whom they were interviewing, rather than in getting technical information about the man himself. That they presumably had available from other sources.

Just to illustrate how different individuals may approach the same end in quite different ways, Mr. Boring started in with the early history and background and followed through. There was one point that occurred to me that I did not hear Mr. Boring ask about. That was the boy's early experience other than his maintenance in college, his early avocations. He brought out his later ones. I was interested to see where he brought out the early interests of the boy and his later ones, his early avocations and his later ones.

F. ALEXANDER MAGOUN: Of course, I should like to reinforce what Professor Bangs has said. There is no doubt, I think, in the minds of anyone who has had experience that Elliott Smith is far ahead of all the rest of us, and most of the things that we do that are worth doing are things we have heard from Elliott Smith. He is not only a great teacher but a great teacher of teachers.

In the first place, you saw this afternoon three men who knew how to interview. Some were saying this is not real, that if you put on a demonstration like this in front of the class it wouldn't be the real thing, to which I reply that Henry Dennison hired a man in my class room two years ago and he has been working for Mr. Dennison for quite a time. When that happens two or three times, then the class passes the word on from year to year that these things are actually done.

Also, I believe that there is just as much to be learned from something that is done poorly as there is to be learned from something that is done well, only it needs more control. From time to time, I bring into my class room someone to interview the boys, someone I know is going to put on a terrible interview. And then in the post-mortem, which does not come immediately afterward, but comes as a succeeding exercise two days later, it gives the boys a chance to think the situation over. We can see why he didn't do a good job, where it was that the student was frightened or something of that sort.

Furthermore, you get away from what Professor Bangs has called the little theater aspect. We make these men think. To make these men think, we give them an assignment, and present it to them before the demonstration takes place, and which they must pass in before the post-mortem. For instance, I would suggest for the sort of thing that happened here an assignment like this: One of your boyhood friends has gone into medicine. You have received a letter from him saying, "Dear Jack. There seems to be something wrong with my approach. I don't know just what it is. Knowing your interest in the human race, perhaps you could help me. I did very well in medical school. My grades were splendid, my knowledge is sufficient, my equipment is up to date. I would be called to a home perhaps once or twice and then never again. What is the matter?"

As the assignment, the class is to answer that letter, and no credit will be given for anything in the letter which is not based on objective evidence taken in the interview.

Coming back to what you saw here this afternoon, I would limit myself to some things that happened. Mr. Boring asked this candidate why he did not graduate this June, and the boy was restless and embarrassed. Whereupon Mr. Boring handled the subject beautifully. He changed the subject right away and he said, "Tell me about earning your way through college." All right. There is a point for the doctor. When your patient is in a sore spot, be sure that you relieve the emotional tension and calm him down immediately. What took place here this afternoon was objective evidence to support every single point to be presented in the letter to the doctor friend.

That makes them study what happens, that makes them analyze what happens. If I asked you which of those three students hesitated every time he was asked a question which was a matter of opinion and gave an evasive answer every time it was a question which was a matter of fact, would you know which one answered what? Suppose I asked you which of the three students got all balled up because the interviewer asked him a question which the student could not possibly answer and he tried to bluff? It is my opinion that the interviewer asked the question on purpose to see whether he would bluff, knowing he asked a question which the student could not possibly answer. He was not concerned with the answer direct to his question but he was very much interested in the personal reaction to the type of situation that boy was in. Things happen that are important and it takes a penetrative mind to analyze them, and our student does not do it until he has given it some important thought and finds out exactly what the interviewer is doing. Then he begins to think.

Furthermore, I think that Elliott Smith is right in saying that these things should be done in teams. The individual boy does not pass in a paper by himself. They work together, not less than three men and not more than five men. There is a difference of opinion. In my class one man acts as chairman. They rotate the chairmanship. The differences are brought together. That sort of thing is of tremendous value in learning something about human relations. Have the boys give their answers as a team.

The post-mortem now about to take place here, in Smith's class room and I hope in my class room, is a very cold medical affair without anesthetics. It is my experience that the boys do not object at all. You can tear them limb from limb and they appreciate it because you have taught them something. It is also my experience that faculties object like everything. Other professors say you

must not do a thing like this because you will hurt that boy's feelings, if you criticize him before his classmates. But the boys themselves do not feel that way about it. They are grateful for learning something before they go out into the great world where it is going to cost them a great deal. You can make one mistake out in the world that will cost you years of your life. It is so much better to make that in the class room and have the mistake pointed out to you. Have you ever stopped to realize that youth asks for the truth and we have not given it to them? Age does not ask for the truth, and sometimes get it.

A demonstration of this sort is pathetic. If you try to rehearse it, it is absolutely pathetic. In my experience the thing must be spontaneous, it has to be real, and each party usually arrives never having met the other. That is the sort of situation you usually have in an interview. If you rehearse it, it is deadly. If the student begins to try that, it is usually wrong in a situation of this sort.

You can turn the situation around. If you are really going to start using the demonstration, do not stop here. Go on. Pick out two students from the class and have them interview somebody looking for a job. For instance, bring in five stenographers, real stenographers, girls actually looking for positions. Explain to them that each one is going to get $2 for her interview anyway and the girl selected will get $5. That makes them try hard. Then, after the interviews, divide the class into halves. The boys over here will vote on which girl they would like to take out and the others over there will vote on which they should hire. Poll the vote and say, "You're excused, ladies. Even business men can be wrong."

Then the students will have an opportunity to see the situation both from the point of view of the applicant and the point of view of the interviewer. They will learn a great deal more that way than they will by being lectured.

I have had one other experience within the last week, perhaps a little more than a week now, which makes me wonder if it is not true that the personnel men know a lot more about students than the faculty does very often. I am thinking of the director of a nationally known research laboratory who was in my office last week, and who told me about an applicant for a position in his laboratory who had been sent him from a western engineering school. He came with very high grades, and with rather important recommendations from the faculty. The director of research started out and said to the boy: "How does a water faucet work?" He did not know.

"How thick should a concrete sidewalk be?" He did not know.

"Approximately what do you think a mile of macadam road should cost?" He did not know.

"What is inside an alarm clock?"

He could not answer that. Gentlemen, that chap wanted to be a research man and yet he did not have enough natural curiosity to find out any of those things. I have a very high respect for what a good interviewer can learn about a man in just about fifteen minutes.

Post-Mortem

MR. BORING: I think without question that we should, on this particular demonstration that I attempted here, first give you just a little background of the interview blank because that you missed. Having then had that information, it will answer, I think, Professor Rogers' question as to whether we had the academic record.

Our plan and our program in approaching the engineering graduate regarding employment each fall is to send out these forms which we have worked out very carefully and to which we have given quite a lot of thought. On that we get quite a lot of information in a simple way. We obtain that early in the school year so that when we interview the boy, as we did in this particular case, we have something of his background. For that reason, it was not necessary to take up the time to try to bring out very much in the way of experience. I should like to tell you what there is derived from the interview blank. The form we have worked out in our own organization starts out by giving the usual name and address, something of the boy's physique. We know in this particular case that we have a young man who has come from a background abroad. He is from a second generation foreign and very substantial family. His father is a shoemaker. We know that he is the middle of a group of seven children, that his background of interest in chemical engineering is not a thing that came originally into his own mind. You can very well see from the demonstration that his interest has rather grown, it was planted there by a brother, going back to nothing in particular. His complete experience and background as shown by the form here indicates that he has been on the golf course, that is, as an assistant golf professional, and as a caddy, that he has saved some money from that particular type of work to prepare himself for a college program.

In this particular interview I attempted two or three times to open myself wide, as I saw the thing, to give the boy an opportunity really of showing what he was interested in, and he was not there, practically. I will say frankly that in this particular case we have a young man who has not had sufficient background of experience in contact with the engineering profession as yet to put his finger in any way on the type of work that he would like to do. We opened a boy up who has taken chemical engineering and who should be primarily interested in something very definite in a chemical way.

He will readily agree that he would like to go to China and be a salesman, having something besides chemical engineering there. When we can do that, there cannot be very much of a definite interest in that particular line of work. Undoubtedly it is there fundamentally, but as yet it has not come out.

I am always very much interested in something of the home background and something of the social instincts of this particular case. I tried to bring that out by the question: "Are you interested in the co-eds?" at which everyone laughed. I had in mind in this a particular thing I have seen a great many times, one of our most difficult situations, a young man of the higher educational level who is thinking on the college plane and who becomes interested in someone who thinks in an entirely different way. Those things almost invariably bring up trouble sometime or other and we try to avoid it. This young man that was with me here indicated to me that he was interested from that particular viewpoint, in a girl of his own type of thinking, one who has been attending the University of Wisconsin. That gave me a tremendous source of light on the future of what this particular case is apt to be.

From the standpoint of scholarship, I could have gone on for considerable time and talked about what he did in this or that particular thing, but the fact the boy has brought out, that he has an honorary fellowship, some of which he made during the junior year, including mathematics, chemistry and other things, was an indication that certainly he was able to make good grades. And although these will be checked always against the records, in my case after the interview I have felt sure that he would unquestionably be graded as a young person who would be an excellent student and unquestionably would stand very high, at least in industry. As to social life on the campus, the interview blank again gives a good deal of that. I note that the boy has had to work on other things during his entire college course and that he has little or no opportunity to go into extensive campus activities. Then I can immediately assume that here is a young man who has been able to make good grades, has had a certain amount of social life, but has been forced, due to the economic situation, to do a lot of very hard grinding on the outside, and we can excuse very easily a certain lack of extracurricular activity on the campus.

The other boys were more at ease to a large extent. The other men had the opportunity of seeing him go through it and they naturally were a great deal easier to approach. The first interview in a thing of this kind would always be more difficult, I think, than the ones that follow. As to the nervousness of the boy and the excess perspiration, in this case I think it can be excused very easily.

There is also the fact that the boy could not shoot into me with leading spars or questions when I opened myself wide open when I asked, "Have you any questions to ask?" There was nothing whatever. I find in this thing he was perfectly willing to agree with almost anything that I asked. But as I have said, I will discount it.

The boy is going home. He is going to sleep on this for the next six or eight months. I am coming out to Wisconsin again and when I talk to him then I expect to get quite a different reaction.

At the present time, if this were a cold interview, looking at the boy on the basis of an interview between four walls and with nobody else present, I would probably say no to immediate employment. On the basis that he is a mature man and has not gone far enough, that boy will gain a great deal more by a year or two in college, in addition to what work he has. I feel that he will blossom out, if he will apply himself in a more social way, by having more extracurricular activities and more contact with people. But my impression at the present time is that I would much prefer to see that boy wait before he sought employment, because that is unquestionably the reason, as he stated in the interview, he had seven interviews this particular spring and none of them had come to a definite employment conclusion.

MR. JOHNSON: I could not accomplish what I should like to do in fifteen minutes, notwithstanding the remark of the gentleman here. I am not equipped sufficiently in that direction. Whether right or wrong in my observation of the young man I interviewed, I could say to him that I should like to see him again. That was the impression that I got from the very short interview I had with him. I do not know whether he has a job or not, but anyway, I should like to see him, have him come around and see me in the near future.

MR. DAVIS: Of course, interviewing at a college is the easiest job that we do, so far as interviewing goes. When we go to a college we have the college record before us, also the opinions of the college faculty. It is much easier for us to interview at a college than it is to take a man who comes into the office where we have no access to any of the basic records.

I cannot quite let Dean Potter get away with those remarks of his without just a little rebuttal. The man I interviewed slipped over next to me and began to ask me a lot of personal questions, and after a discussion started I had to say, "I will go into it more thoroughly with you after this meeting is over." I just want to say that as Mr. Boring was ending his analysis, Mr. Mayland said to me, "That is a splendid analysis of the man whom Mr. Boring interviewed. I run around with him all the time and Mr. Boring has got him cold."

I will say just one more thing I think I would not have said otherwise. I feel a little necessity of pointing it out because of what Dean Potter has said. As Mr. Boring was finishing his remarks, Mr. Mayland said, "I think Dean Potter was right. You can't know much about me."

I asked, "Why?"

"You didn't ask me any special questions about a lot of things."

I replied: "No, but I believe I learned a good deal. For example, you like to analyze things very much indeed. Don't you? You prefer to analyze things rather than to synthesize. You are quite cautious and not inclined to go in for much social activity. Am I right?"

"You are right," he said, "but you didn't ask me any questions along those lines. I want to find out some more from you."

It may not be apparent how we do it. Some of us may not know just how we do it, but it is a part of our job. A man should do a better job than the general average after he has had much experience and after he has had his share of successes and failures, and has studied them. If he cannot then do the work a little better than anyone who picks up that job offhand more or less, he should not hold the job.

Mr. Mayland gave me an application filled out on a Bell System form. Mr. Mayland, as you undoubtedly know, is of Scandinavian descent. His father is a painting contractor. I had this information that you did not have. He is now in chemical engineering and will graduate next February. He belongs to Pi Eta Sigma and Tau Beta Pi. He is a member of the student branch of the American Society of Chemical Engineers. He has had some summer work. If Mr. Mayland had been left alone to get his job, or if he had applied to someone who was not the least experienced in interviewing for employment, you can see that Mr. Mayland would probably end up in a research laboratory. His idea of the factory was production, and he needed some help on that. So very many of your students need such help. That is one reason we have been trying to encourage and stimulate an interest in your teaching by putting on demonstrations of this kind, so that when these men come to our offices they will not come unprepared for an interview. We should like it very much (it would help the interviewers and the students so much) if you would give them some of these ideas early in their college years, and by demonstration, or teaching, or talking, or reading, anything you can give them, get them started thinking. That is the main thing. Get them started thinking, "What do I want to do?"

I open up almost every interview for employment as I opened up this one to-day. "What would you like to do if you could have any

job anywhere?" I wanted to get Mr. Mayland away from any specific industry like the telephone business. I find that it is very easy, almost from the beginning of any employment interview, to get the applicant away from the job for which he says he is applying. There is only one reason for that. He comes to the interview with little or no previous consideration of his own interests and of the activities of the concern to which he is making application. In my case he has not gathered information about the telephone business any more than he has studied the General Electric or any other business to which he applies. He simply comes in there with an idea in the back of his head, which is all right in a way, but it does not go far enough. He feels that he is a pretty good man. He is going to succeed wherever he is placed. All he has to do is get a job somewhere. He is going to cast around and find something that interests him, and from that point on he is going to be successful in life. He comes in without a thought of preparing for the interview and with no thought of what he wants do to. He says, in effect, "Here I am, Mr. Employer. You probably know more about me than I know about myself. Take me and put me where you think I belong. I will work hard and I am sure I will be a success."

That is what we get continually day after day. I want to give an illustration to prove that I am not unreasonable in this request that you teach men to know something about seeking employment. I spent an evening with Paul Boynton of the Socony-Vacuum Company about a month ago at New York University, where we put on a demonstration of this sort. Paul Boynton had conducted an interview for employment in China. That night I said to him, "Paul, when I have wanted to illustrate to men, whom I have tried to help get jobs, that their preparation need not be difficult or involved, I have said to them: 'You should prepare yourself for every interview. Now I do not mean that, if you apply to the Socony-Vacuum Company you should be able to say: "I want to do a certain type of work in connection with a specific job in China." They should be able at least to say:

"'Mr. Boynton, I want a job with your Company because you have the type of work that I would like to do. I know from inquiry that when you are hiring a good many college men you place them in four different types of work, as a rule. Some few men go into research in refineries on methods of refining, lubrication problems, and other research. I am not particularly interested in that. Others are placed in production work in the refineries. I might be interested in that. Others are employed for foreign service, in China, for example.'

"I told these men: 'You should learn in what countries Socony-Vacuum operates. Be careful not to mention some country in which

they do not do business.' You could then continue: 'I would not want to go to China because I am an only child. My father's health is not any too good and I might be called home suddenly. So let's leave out foreign service. But there is another type of your work that interests me a lot. I would like to start in a gas station. I would like to sell gasoline, tires and other products. I believe that some day I could prove to you that I could run a gas station well, so you would put me in charge of one. Then I would try to do that job so well that you would put me in charge of a number of gas stations, or the securing of large accounts. Then I would feel I had arrived where I would like to be, in your merchandizing department. I would like to be a merchandizing man.'"

I said, "Paul, have any of those fellows come to you and given you that story?"

He replied: "Howard, if a fellow came to me and said that, I would say, 'You are hired.' Nobody has done anything like it yet."

MR. NIKORA: Well, perhaps I might tell you this is the twenty-third interview I have been through in the last two months. And as a consequence, perhaps I have grown somewhat calloused. I think what ails most students is the thing that Mr. Davis just spoke of, that is, that most of us do not know what we want. We realize that there is the whole world before us and that we are supposedly equipped with an education, but we do not know just how to fit that in with the various things that are out in the world. A good many of use are bewildered the first time we walk in to be interviewed, just as I was, sitting there. Believe it or not, that man is the man who really makes the company's impression. If I walk in to see a gentleman and he is not on time at the interview, I mark that against that company. I feel that is something that operates against that company.

Perhaps I might tell of some interviews I have had. For instance, one gentleman from a rather large company sat at the table. When I walked in, he introduced himself. He asked me my name, and we got acquainted with just those few words. He told me to sit down, which I did, and then he said, "Now, talk," There was nothing harder on earth to do. I did not know what to say. I will bet if I had had graduates with me they would not have known, either.

On the other hand, I have been interviewed by a man with another man sitting at the end of the table. He will get up and move around and yet not say one word all during the interview but keep marking things down on a piece of paper. While the other man is talking to you, you are under a considerable strain. Still, we walk into those things not positive of what we want to get into. There are some students, I admit, who really know what they are

going to do. They have studied it and they are older than most of us. One man may be sitting there, as I have said, observing all our moves, while the second man is trying to hold our attention all the time. Then you are more confused than ever.

On the other hand, I had another interview with two men who sat with the students. The first question asked was: "What about the Bernoulli theorem?" Well, that was not so bad, but when the meeting resolved into a matter of figures, and an hour and a half later we were trying to figure out if there was a third law of the conservation of energy, I did not feel that any of the students thought that was a good interview.

There was another type of interview given by another big concern, in which the gentleman spoke to us for about fifteen or twenty minutes, and was very friendly. The first impression there was that you liked the company because you felt that all men in the company were like the gentleman who spoke to you. He would give you an adequate chance to express yourself and your ideas. Then he said, "Won't you please take one of our forms and bring it back this evening?" In the evening, when you got to the designated place, you found out that to all students interviewed he had told the same thing. You had congratulated yourself on the fact that you happened to be picked. But after he sat down in the little room that he had prepared he gave you a psychological examination which lasted an hour and a quarter. I felt that that was asking too much of a student. It seems to me that they should be choosing the student on the basis of his potential value but they were not giving him a real, honest chance to tell in what he was interested.

It is rather difficult to say just how you are impressed in an interview here because there is the element of having many people watching you. After the student has gone through a number of interviews he has a definite set of things running through his mind as he walks in to be interviewed. I think a good many companies have lost sight of the fact that there are lots of students in college who are looking for companies they want to work for, and there are certain companies he would not work for. Many companies have lost sight of the fact that students are just as selective as the companies are. That point was brought home to me at one interview in which several students were being interviewed at one time. The gentleman asked us if we would be willing to work anywhere for his company. Every student answered that he would. They really would not have said otherwise, as I think it was done under the strain of the interview.

I have to say this about Dean Potter's methods. I do believe that in the long run the faculty knows more about us than the personnel men. I admit a great respect for Mr. Boring and his kind

analysis, and for Mr. Davis. They both have studied it a great deal. They have the right idea in interviewing and know the main things to look for, but I do not believe the majority of the companies do that. I feel that the student has a greater sense of security in the faculty itself. They can say, "Here is a company that wants a man of your type. That is the kind of a company you should work for because you are ideally fitted for it." The student has the education and he has the bent to go with that particular company. In that respect I think that Dean Potter expressed a very good idea.

July 17, 1936

My dear President Anderson:

I wish to express my thanks to the 1936 S. P. E. E. Convention.

The opportunity which Professor Bangs of Cornell gave me to speak at the demonstration interview has flowered forth into something quite miraculous—14 positions have been offered me as a consequence. Before the convention, I was fortunate enough to have almost double that number open to me. But one of this last group of fourteen is one which I am choosing. And I feel that I must thank the S. P. E. E. for such a splendid turn of events.

May I ask, also, a favor of the S. P. E. E.? I realize that a letter of thanks is very feeble in its expression—so, if I could, may I please be asked to help, in some way, the next convention? That is the one way in which I feel that I could repay the benefactors to whom I am very much obligated.

Information has come to me that the convention proceedings are to be published. Since my words will appear in print, I should be greatly indebted to you for any clue at all as to where I could get a copy—my mother would prize it highly.

With much appreciation for what the S. P. E. E. has given me,

Yours very truly,

(signed) Leo S. Nikora

PRACTICABLE OBJECTIVES IN TEACHING ENGINEERING ECONOMY *

By EUGENE L. GRANT

Stanford University

Several years ago, in developing an advanced course in engineering economy through the class discussion of actual problems, I hunted through the engineering press for examples of confused reasoning in dealing with matters of technical economy. I found that confused reasoning is surprisingly frequent in writings dealing with specific problems of economy. In fact, the supply of "horrible examples" far exceeded my need.

It seems reasonable to suppose that among the far more numerous group who do not appear in print, the proportion of confused thinkers on engineering economy is even greater. This inference is reinforced by conversations with people who have an unusual chance to observe engineering reports on matters of economy. It is also reinforced by personal observation.

An engineering economy study is an attempt to find the answer to the question "Will it pay?" which is asked about some proposed course of action where technical considerations are involved. Such a study may apply to anything from a major project such as a power-plant costing millions to a minor choice in a detail of design. It is the merit of the engineer's training that his impulse is to find the answer to questions of economy by calculation rather than by conversation. However, apparently it is frequently a deficiency in his training that he does not know what calculations to make, nor how to make them.

An examination of the way in which economy studies may go wrong is relevant to the question of how to teach engineering economy. To see the way in which such studies go wrong, we may consider five steps which are likely to be part of any study. These steps are as follows:

First, defining the physically practicable alternatives.

Second, predicting the amounts and times of prospective money receipts and disbursements associated with each alternative.

Third, defining those prospective money receipts and disbursements which are relevant to the choice between any two alternatives.

* Presented at Conference on Engineering Economy at Madison Meeting, S. P. E. E. June 23, 1936.

Fourth, making the calculations to reduce these money forecasts about alternatives to a comparable basis, and finally to a calculated difference. This calculated difference indicates only that "if receipts and disbursements turn out as forecast, then, *all other things being equal,* it will pay to select the alternative which the difference favors."

Fifth, making a decision between alternatives. The process of deciding involves weighing the calculated difference *along with* all elements of the situation which have not been reduced to money terms.

Of course an economy study may go wrong in any one of these steps, or in all of them. Thus the engineer may fail to recognize some alternative which is really better than any one which he considers, or he may make errors in translating alternatives into terms of money and time by incorrectly estimating any of the following items: first cost, or the services to be performed over a period of time, or revenues, or expenses of operation and maintenance, or the economical lives of machines and structures. Frequently the estimator may fail to recognize clearly the differences between two alternatives which are relevant to the choice between them; this is more likely to be true in situations involving increment costs or sunk costs. Or, in reducing estimates to a comparable basis, the estimator may err by failure to recognize the time value of money or by recognizing it incorrectly. Finally, he may fail to give adequate weight to intangibles or may allow insufficient safety factor against the event of conditions turning out differently from those on which the estimates are based.

In considering the relation of these various ways in which economy studies may go wrong to the problems of teaching engineering economy, it is helpful to consider an analogy of some field of engineering in which teaching has been developed much longer than in the field of engineering economy. For instance, let us compare various aspects of instruction in engineering economy to similar aspects of instruction in structural design.

The design of a structure involves a forecast of services which the structure is to perform. This forecast must be translated into terms of forces, just as in the economy study it is necessary to translate the forecasts into terms of money. A structural designer will forecast his dead loads and live loads, his wind loads and other possible forces. He must also forecast the properties of the engineering materials which are to be used, their moduli of elasticity, elastic limits, strengths in tension, compression, and shear. All of these forecasts are subject to some uncertainty.

Having made the forecasts about the forces acting on a particular structure, the designer will then apply the principles of

mechanics to determine the stresses in the members of the structure. This involves a systematic presentation of forces, possibly on a free-body diagram. Such a diagram serves to define the problem and separate the relevant factors from the irrelevant, so that the generally accepted principles of mechanics may be applied to the determination of stresses.

Finally, in the design of a member of the structure the designer must combine his calculated stresses with his forecast about the qualities of materials. In so doing he customarily interposes a safety factor, which is really a factor of ignorance, a recognition that his forecast regarding forces and resistances of materials may turn out to be incorrect.

Now note how the various steps in the structural design problem parallel those in the economy study. The defining of the services to be performed by the structure corresponds to defining the alternatives in an economy study. The translation of services into terms of forces corresponds to the translation of alternatives into terms of prospective money receipts and disbursements. The construction of the free-body diagram corresponds to a separation of the relevant from the irrelevant costs and revenues. The calculation of stresses corresponds to the calculations involving the time value of money. The designer's choice, based on a factor of saftey, corresponds in the economy study to the final judgment reached by weighing intangibles, including uncertainty of forecasts.

I suppose most teachers of structural engineering would agree that it is not practicable for engineering colleges to turn out thoroughly qualified structural designers. They would probably also agree that it might reasonably be considered the function of the engineering colleges to turn out men who are qualified to define the elements of a stated design situation by constructing a free-body diagram, and to apply the principles of mechanics to solve the problem so defined. They might also feel that their graduates should have been introduced to the entire design process even though their judgments had not been trained to meet all of the different contingencies which might arise.

My view as to what we should try to do in teaching engineering economy is similar to this view about the teaching of structural design. Given a clearly defined set of money receipts and disbursements for two alternatives, a student should be able to compare them, giving consideration to the time value of money. Rather to my surprise, many of my "horrible examples" from published articles showed a failure to reason clearly even at this point. For instance, one writer divides $500, a prospective saving for six years, by his assumed interest rate, 6 per cent, and concludes that his answer of $8333 is the investment justified in order

to effect this saving; apparently he failed to appreciate the assumption of perpetual service which a capitalized cost comparison implies. The article in which this mistake was made not only appeared in one of the reputable management journals but was quoted verbatim in a textbook written by an engineer—not as a "horrible example" but as an illustration of how economy studies should be made! This failure to appreciate the implications of a capitalized cost comparison is quite common; in one book written about problems of economy in a particular engineering field this mistake is made repeatedly.

In addition to learning how to think straight about the time value of money, the student should develop some skill in differentiating the relevant from the irrelevant factors in comparing two alternatives—that is, he should have some technique for dealing with increment cost situations and sunk cost situations. This seems to be the point where the engineer in practice is most likely to fall down; there seem to be numerous obstacles to recognizing that certain costs will take place regardless of which of two alternatives is selected. From the standpoint of instruction in economy, this objective involves some difficulties; but at least it is practicable, I believe, to keep the best men in a class from falling into some of the usual errors of reasoning in common situations such as those in which it is desired to determine the economy of a proposed replacement.

Finally, the student should complete his course with some notion as to how to go about an economy study. Particularly, he should recognize that technical problems are in the final analysis problems of economy.

Other elements necessary to successful economy studies must to a considerable extent be left to develop with maturity and increasing engineering experience; the inclusion of them in a course in engineering economy should be with the idea of giving the student the picture of the steps to be taken rather than technical proficiency in carrying them out. This applies to such things as estimating costs and revenues and the translation of the alternatives into money terms. It also applies to making forecasts about prospective changes and to making final judgments between alternatives which weigh the irreducible elements along with those reducible to money terms. The development of men who will start their economy studies by recognizing all of the alternatives in a particular technical field is a problem for the advanced technical course rather than for the course in engineering economy, in so far as it is a problem for the engineering college at all.

This entire discussion has a bearing on the important question in engineering education of what, if anything, to do about the

subject of engineering economy. Three views are held on this general question. One is that no instruction whatever should be given. The second is that whatever instruction in engineering economy is given should be confined to the advanced technical courses and should deal with the problems of economy in the field of the advanced technical course. The third is that it should be given in a separate course. The observed failure of engineering graduates to reason clearly about situations involving economy may be in part a result of following the first two policies by engineering teachers.

It seems to me that the view that no instruction in engineering economy should be given the engineering student is unreasonable if it is recognized that choices between technical alternatives must be made on the basis of economy, and if it is further recognized that there are definite principles to be used in making calculations about economy. It is as if we were to expect structural designs to be competently made without any consideration of the principles of mechanics.

The view that whatever instruction in engineering economy is given should be confined to the technical courses in specific fields is somewhat more alluring. There are certain practical objections to this plan, however. One obvious objection is that if such a policy were really adopted by the instructors in all advanced technical courses, there would be likely to be considerable duplication in instruction in those fundamental principles of economy which are common to all technical fields. An even more serious objection is the difficulty of getting any mention of economy at all in advanced technical courses—much less any consideration of general principles of economy. My own experience with teaching advanced technical courses has been that there is so much technology to discuss that there is little time to discuss economy.

It would seem, therefore, that if engineering economy is to be taught effectively the best place to do so is in a separate course. Such a course may well be thought of as bearing a relation to the general problems of making of engineering decisions similar to the relation of the courses in the fundamentals of mechanics to the general problems of structural design.

Discussion

Professor Norton tells me that a majority of our members engaged in teaching design courses feel that "engineering economy" should be taught therein rather than as a separate course such as contemplated by Professor Grant in his excellent volume.* With

*"Principles of Engineering Economy," by Eugene L. Grant, Ronald Press.

a well chosen and coördinated experience of ten years in industry and twelve years in teaching, I feel competent to express an opinion on this subject.

I believe all competent design teachers continually stress the cost features from a qualitative basis. I do not believe it possible to treat adequately the question of costs in any undergraduate design course from a quantitative standpoint. One can readily realize the amount of time spent on design in commercial engineering departments. With this one can compare the amount of time normally available to cover the subject in college. The tendency, for which I am thankful, seems to be to get away from empirical design to a more thorough analysis by rational methods and a greater stressing of fundamentals. This leaves even less time for cost analyses.

After an experience of six years in developing a course in so-called "engineering economy," I am thoroughly sold on its value. It should supplement and serve to clinch the ideas given in design courses in a way that could not otherwise be done.

I do, however, have a very definite conviction that the course should be given in the senior year and by an engineer who has had a range of industrial work. My own experience indicates conclusively that students without the engineering training fail to derive complete benefits from such a course, and yet engineering students fail to acquire sufficient cost instruction from the standard courses usually given in the business administration departments. There is little question that a course such as above contemplated, should be preceded in each instance by a course in economic theory given by the economics department.

CARROLL D. BILLMYER

1937 SUMMER SESSION IN ECONOMICS, JOHNSONBURG, N. J., JUNE 18–26

Plans are proceeding for the eight-day session to be held just prior to the Boston meeting under the auspices of the S. P. E. E. Committee on Engineering Economics at the invitation of Stevens Institute of Technology.

The morning program is complete. Speakers on course content and teaching methods in Economics are Scholz of Wharton, Lilly of Swarthmore, Grant of Stanford, Eidmann of Columbia, Norton of Virginia Polytechnic, Ayers of Wisconsin and K. W. Jappe, who has been heard by this group before. Jappe will speak on "Bread and Butter Economics." Ayers will discuss teaching opportunities in the borderline fields between engineering, economics and sociology.

In the evening, the following have at this writing agreed to speak:

John M. Carmody, Administrator Rural Electrification Administration; formerly Member National Labor Relations Board.
Ralph E. Flanders, President, Jones and Lamson Machine Co.
Frederick Dewhurst, Economist, Twentieth Century Fund.
W. H. Rastall, formerly Chief of Industrial Machinery Division, U. S. Department of Commerce.
S. L. Andrew, Chief Statistician, American Telephone and Telegraph Co.

The eight-day course on Industrial Economics, to be given mornings, jointly by Kimball of Cornell and Ennis of Stevens, is definitely arranged.

Similar courses by Barnwell on Industrial Management and by Uhrbrock on Industrial Psychology will be conducted as previously announced.

ENGLISH NOTES

DEVOTED TO THE INTERESTS
OF TEACHERS OF ENGLISH
IN ENGINEERING SCHOOLS

J. L. VAUGHAN, EDITOR

THE PLACE OF ENGLISH IN THE ENGINEERING CURRICULUM

By A. A. POTTER

Dean of Engineering, Purdue University

"The engineer," said Marcus Vitruvious (B.C. 150), "should be a good writer, a skillful draftsman, versed in geometry and optics, expert at figures, acquainted with history, informed on the principles of natural and moral philosophy, something of a musician, not ignorant of the sciences both of law and physics. . . ."

The above specifications for the qualification of an engineer, laid down over 2000 years ago, are true today. Marcus Vitruvius considers the power of self expression as the first prerequisite for an engineer.

Dr. J. A. L. Waddell, Consulting Engineer in his addresses before the students of Barcelona, Spain, stated:

"There is a general opinion amongst engineering students that the study of one's own language is not of great importance, as compared with that of mathematics and technics; but, believe me when I tell you that this idea is fundamentally and absolutely wrong. To become a successful engineer, one must be capable of persuading others concerning his ability to do contemplated work; he must be able to draft his specifications and contracts with clearness; and his reports need to be not only plain, sound, and convincing, but also pleasing, and even elegant, in diction. In order to augment his technical vocabulary and to understand what he reads and hears about various lines of engineering, an undergraduate should study glossaries of technical terms, especially those having illustrations, so that he may recognize, when he sees them, the different parts of structures and machines."

The dean of engineering at Purdue University tells his freshman students at their first convocation that English is the most important subject in the engineering curricula, and that they must acquire the ability to write and speak their mother tongue with ease, clarity, vigor and correctness, if they expect to succeed in life. While twelve semester hours of credit in English is required, the engineering student at Purdue University is encouraged by the Engineering Staff to elect additional courses which will prove helpful to him in improving his mastery of language and his appreciation of good literature. The majority of the 400 senior engineering students at Purdue University have to their credit additional courses in literature, drama, poetry, speech, debating or writing. This is gratifying when one finds that the grade distribution of the English Department places it in the category with the more difficult scientific and engineering subjects.

The quality of instruction given by the teachers of English at Purdue University, and their insistence upon thoroughness, fairness and clarity of thinking have resulted in a fine mental attitude on the part of students and teachers alike with reference to the importance of English in the engineering program of study.

The T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE DIVISION OF ENGINEERING DRAWING

FRANK A. HEACOCK, EDITOR

Functional Sketches.—A technical sketch is a freehand drawing of a technical subject. It may be classified as constructional or functional according to its primary purpose. The constructional sketch is essentially a freehand working drawing which, although quickly made without instruments, is complete enough to permit actual construction. The functional sketch, on the other hand, strives to make clear a principle of operation. It shows how something works rather than how it is made.

The functional sketch is usually an assembly of related parts having interior arrangements whose purpose must be clearly shown. Since clarity is the prime requisite, every means should be used to simplify the sketch. Some advantageous methods are:

The judicious use of informative sectional views;

Substitution of more elementary and familiar details that would function in approximately the same manner as the actual more complicated design;

Use of symbols, particularly in fields where they have been standardized;

Omission of details of secondary importance when a brief note would explain their function more clearly than a graphic representation;

Use of distinctive kinds of broken lines to indicate the path of different materials, and of distinctive cross-hatching for parts that are functionally different or have different motions (contrasting colors may often be used for this purpose);

Adoption of a natural sequence, as from left to right or from top to bottom of sketch, particularly where the flow of fluids or other materials is involved.

Functional sketches are a valuable aid to clear understanding of mechanisms of all kinds. They are indispensable in the class room, the textbook, technical reports, instructions for installing and operating equipment, and the like. They are often essential to a

clear presentation of a problem that must be analyzed, calling for exact technical knowledge. In this respect they make admirable answers to properly worded examination questions on technical subjects.

The writer's experience indicates that the average engineering student is not at all proficient in drawing functional sketches. Sectional views in particular seem to be a pet aversion among students, probably because they might reveal a lack of understanding which can be concealed behind an ambiguous jumble of dotted lines. Because of the value of the functional sketch, a plea is made that more attention be devoted to this useful form of freehand drawing.

Contributed by PROF. E. P. CULVER, Princeton Univ.

Mailing List—Journal of Engineering Drawing.—A revised mailing list for the *Journal of Engineering Drawing* is now being compiled. Those who are interested in receiving the second and third issues should send their names at once to John M. Russ, 208 Electrical Engineering Bldg., State University of Iowa, Iowa City, Iowa.

Drawing for the National Drawing Competition for 1937 of the Drawing Division will be exhibited at Cambridge, Mass., in June 1937. For specifications and entry numbers write to Carl L. Svensen, Box 933, Lubbock, Texas.

SECTIONS AND BRANCHES

The meeting of the Section was held on the Farm Campus of the **University of Minnesota,** February 15, 1937. Dinner was served at the dining hall at 6 P.M. President W. H. Kirchner presided at the meeting. The minutes of the fall quarter meeting were read and approved as read.

President Kirchner appointed the following as members of the nominating committee: R. E. Montonna, O. W. Potter, H. B. Roe.

The secretary read a communication from H. D. Orth, Secretary of the recently organized North-Midwest Section of S. P. E. E. inviting the University of Minnesota to become a part of that Section of S. P. E. E. At the suggestion of President Kirchner, action on this matter was deferred until the spring meeting of the Minnesota Section.

Another communication from Frank C. Vilbrandt, Chairman, S. P. E. E., Chemical Engineering Division, was heard. It was requested that the Minnesota Section select its representative on the Executive Committee of the newly organized Chemical Engineering Division. By resolution of the Section President Kirchner was authorized to appoint such a representative.

The chairman now introduced Professor William Boss, Chief, Division of Agricultural Engineering, who addressed the group on the subject of "Engineering in Agriculture." Professor Boss described briefly the situation in agriculture and showed the opportunities and needs for more engineering in agricultural equipment and practices. Following the address the group adjourned to the Agricultural Engineering Building where an inspection was made under the guidance of Professor Boss of the facilities and equipment.

Thirty-one members were present.

A. J. SCHWANTES,
Secretary

The **Pacific Northwest Section** of the Society will hold its fifth annual meeting at Butte and Bozeman, Mont., May 13, 14, 15, 1937. The general theme of the meeting is "Recent Trends in Engineering Education."

Thursday evening there will be an informal dinner at Butte and an inspection trip of the School of Mines Friday morning. Friday afternoon the group will motor to Bozeman. At the informal dinner that evening President Atkinson will give an address fol-

lowed by a paper on Investigation and Administration of Student Loads.

Saturday morning will be devoted to an inspection of the Montana State College. At the technical session in the afternoon, three papers will be given: The Place of the Professional Society and Student Branch on the Campus; The Need for Real Graduate Work in the Northwest; A Course in Geological Engineering. In the evening there will be an Advanced Report on Fort Peck Dam and it is hoped to have one of the officers of the Society present to deliver an address.

L. D. CONKLING, *Chairman.*

The **Pacific Southwest Section** held its fifth annual meeting at the University of Arizona, at Tucson, on December 28, 29 and 30, 1936.

The following papers constituted the program, which was prepared by the program committee, under the chairmanship of Mr. John W. Hazen, of the Los Angeles Junior College:

"Report of the Mechanical Engineering and Machine Design Section Meetings at Madison, Wisconsin," by Professor A. B. Domonoske, of Stanford University.

"Curriculum Accrediting—A Progress Report," by Dean G. M. Butler, of the University of Arizona, with discussion by Professor Thomas T. Eyre of the University of Southern California.

"Registration of Engineers and its Effect on the Engineering Curriculum," by Dean F. H. Sibley, of the University of Nevada.

"Humanities and the Engineer," by Professor F. H. Fowler, of the University of Arizona.

"Textbooks—Types and Selections," by Dean Geo. L. Sullivan, of the University of Santa Clara, with discussion by Professor F. H. Cherry, of the University of California.

"Teaching Loads of Engineering Teachers in Junior Colleges," by Professor Daniel E. Whelan, Jr., of Loyola University, with discussion by Professor Franklin O. Rose, of the University of Southern California.

"Engineering Education Club—An Activity of the S. P. E. E. Members at the University of Arizona," by Professor James C. Clark, of the University of Arizona.

"The Laws of Learning," by Professor L. M. K. Boelter, of the University of California, with discussion by Professor O. A. Simley, of the University of Arizona.

"Student Advisers for Junior College and University Students," by Professor H. B. Walker, of the University of California, with discussion by Professor T. C. McFarland, of the University of California.

"The Technical Moving Picture as an Aid to Laboratory Instruction," by Professor E. D. Howe, of the University of California.

Two of the most enjoyable features of the entertainment afforded the members of the Section and their guests were illustrated lectures by Dean Byron C. Cummings, of the University of Arizona, on the ancient Indian architecture of the Southwest and by Professor A. E. Douglas, of the University of Arizona, on the dating of pre-historic ruins by a calendar compiled from thousands of tree ring measurements. This calendar has been carried back to the beginning of the Christian Era in the form of a chart, showing widths of tree rings as affected by years of varying amounts of rainfall. By means of the chart, ancient dwellings may be quite accurately dated upon examination of the rings in the roof timbers used in their construction. Some of them were found to have been built in the twelfth and thirteenth centuries. This constitutes one of the most valuable single contributions to the science of archaeology in the Southwest.

President P. S. Burgess, of the University of Arizona, extended a formal welcome, which was splendidly carried out by the University of Arizona members and their colleagues. An inspection of the fine new buildings on the campus was made on the first day and this was followed by a visit to the University of Arizona Mineralogical Museum, where was seen Dean G. M. Butler's fascinating collection of gems. Another very interesting occasion was an evening visit to the Arizona State Museum, located on the University of Arizona campus, where is housed a very comprehensive collection of pre-historic and recent Indian culture. An automobile trip, arranged by the entertainment committee, to the neighboring Mission San Xavier, built by the Indians under the direction of the early Spanish padres, afforded considerable enjoyment. Several of the visitors made individual trips to the Mexican border at Nogales, a sixty-five-mile drive from Tucson.

The annual banquet of the Section was held at the Pioneer Hotel, in Tucson. Professor Baldwin M. Woods, of the University of California, was the speaker of the evening and he gave a very interesting talk on "The Relation of the Engineer to Planned Development," in which he outlined the manner in which plans for future development of our natural resources are being coördinated by committees of engineers for the government. After the

banquet, the members adjourned to the campus, for a visit to the Steward Observatory.

Upon the nomination of the Nominating Committee, with Dean Sibley, of the University of Nevada, as chairman, the following officers of the Section were elected for the year 1937:

Chairman: Mr. John W. Hazen, Los Angeles Junior College.
Vice Chairman: Dean Geo. L. Sullivan, University of Santa Clara.
Secretary-Treasurer: Professor Franklin O. Rose, University of Southern California.

Other Members of Executive Committee:
Professor John C. Park, University of Arizona,
Professor L. M. K. Boelter, University of California,
Professor R. W. Sorensen, California Institute of Technology.
Mr. F. W. Rose, Taft Junior College.

The invitation of the Los Angeles Junior College for the 1937 meeting of the Section to be held at that institution was accepted and the dates selected were December 28th, 29th and 30th.

FRANKLIN O. ROSE,
Secretary-Treasurer

THE TEACHING LOADS OF ENGINEERING TEACHERS IN JUNIOR COLLEGES

BY DANIEL E. WHELAN, JR.

Loyola University

The Committee on Junior Colleges of the Section has been instrumental in the past years in the presenting, before this body, of papers designed to inform us as to the function of junior colleges in engineering education. Matters relating to curricula, equipment, and student guidance have been dealt with; to the end that there is now a pretty general understanding of the work which these institutions do and of their relation to the four-year institutions.

For this year the general suggestion has been made that consideration of matters relating to teaching personnel be brought before this body. The specific suggestion came from several sources that we consider the question of the teaching loads of junior college teachers of engineering with the purpose of finding out how these loads compared with the load of the teacher in the four-year institution. As chairman of the Junior College Committee and with the approval of Mr. Hazen, our program chairman, I prevailed upon Professor Franklin O. Rose to undertake the assign-

ment of preparing such a paper. He prepared and sent out to various junior colleges a brief questionnaire designed to elicit information upon which to base his paper. Mr. Arthur Gehrig of Pasadena Junior College provided some results of a questionnaire which he had submitted to some of the engineering departments of colleges and universities in this section. An untimely bout with the influenza and his already considerable burden as secretary-treasurer of this organization made it advisable for someone to lend assistance to Professor Rose.

Mimeographed forms, to be filled in by individual instructors were sent to the junior colleges in this section. The information requested came under six headings, namely; courses taught, number of students in the class, the number of hours of lecture per week in each class, the number of hours of laboratory per week, the average number of hours per week devoted to preparation and correcting of papers, and lastly an estimate of the time spent weekly on other duties connected with the position as teacher. Replies were received from twelve institutions and consisted of records of forty-five individual teachers.

The results of this survey are shown. The means of each column are shown at the bottom of the sheet and at the right of the column. Two of the reports covered part time work and were left out of the tabulation. A very close correspondence in hours of work was evident for eleven of the institutions reporting. One institution, from which four instructors reported, showed abnormally high loads. Two of these instructors carried loads nearly twice that of the average of all others reporting. The averages shown on the tabulation sheet are for thirty-nine reports from eleven institutions. The averages for forty-three reports from all twelve institutions were about one hour higher in each column. Thus, for column five, the average for the forty-three reports was 15.70 hours. The average for the thirty-nine reports was, as shown, 15.00 hours.

The average number of classes taught by an instructor was 4.93. The average number of students to a class was 21.60. The largest number of classes for a single instructor was eight; the minimum was two. The largest average class for a single instructor was forty-five; but this man taught only two classes.

The replies to the questionnaire sent to the four-year institutions teaching engineering showed that the majority based their teaching loads on the system which counts each hour of lecture as one hour of load and each two hours of laboratory as one hour of load. On this basis the average teaching load of seven institutions was almost exactly 15 hours.

The data of this survey seem to justify the following conclusions:

TEACHING LOADS OF FORTY-FIVE TEACHERS OF ENGINEERING SUBJECTS IN JUNIOR COLLEGES

	I Lecture Hours	II Lab. Hours	III Hours of Prep.	I plus II	I plus ½(II)	I+II+III
1.	6	12	22	18	12	40
2.	6	12	16	18	12	34
3.	12	6	23	18	15	41
4.	6	16	26	22	14	48
5.	3	15	26	18	10.5	44
6.	10	8	12	18	14	30
7.	10	10	26	20	15	46
8.	3	18	15	21	12	36
9.	6	12	20	18	12	38
10.	10	14	26	24	17	50
11.	7	12	28	19	13	47
12.	3	17	7	20	11.5	27
13.	12	6	21	18	15	39
14.	9	13	19	22	15.5	41
15.	16	13	10	29	22.5	39
16.	12	9	13	21	16.5	34
17.	3	15	6	18	10.5	24
18.	12	6	21	18	15	39
19.	10	12	21	22	16	43
20.	9	10	10	19	14	29
21.	5	18	15	23	14	38
22.	7	15	15	22	14.5	37
23.	7	15	18	22	14.5	40
24.	12	18	11	30	21	41
25.	13	7	23	20	16.5	43
26.	12	6	18	18	15	36
27.	15			15	15	
28.	9	12	15	21	15	36
29.	10	18	20	28	19	48
30.	6	15	22	21	13.5	43
31.	12	9	14	21	16.5	35
32.	16		27	16	16	43
33.	16	6	30	19	16	49
34.	11	8	17	19	15	36
35.	6	12	29	18	12	47
36.	13	30	22	43	28	65
37.	16		15	16	16	31
38.	13	12	30	25	19	55
39.	8	40		48	28	
40.	9	9	17	18	13.5	35
41.	15	6	19	21	18	40
42.	7	15	21	22	14.5	43
43.	18	7	20	25	21.5	45
Av.	9.72	11.70	19.24	20.51	15.00	40.36

I. The average junior college teacher of engineering carries about the same load as the teacher in the four-year institution, 15 credit hours in each case.

II. There are some cases of abnormal loads, a single institution being responsible for half of these.

III. The number of classes taught by the junior college instructor and the number of students per class is not excessive.

Some remarks on the returns relative to committee work, teachers meetings, and extra-curricula activities did not permit of very definite analysis; but left the general impression that the time so involved was considered excessive. It might be said, in passing, that such a feeling is perhaps not unique to the junior college instructor.

Discussion

By FRANKLIN O. ROSE

University of Southern California

The excellent report prepared by Professor Whelan, based on statistics furnished by the junior college instructors themselves, does not appear to leave a great deal of room for discussion. As Professor Whelan points out, the situation seems to be much more favorable than the casual remarks of many junior college instructors had indicated.

I had been asked by the committee to prepare the report which we have just heard, because of an erroneous impression that I had an intimate and broad knowledge of conditions. While that knowledge may have been intimate, the results of the questionnaire showed it to have been very narrow indeed; I was more surprised than anyone by those results. My junior college experience happened to have been with the institution which Professor Whelan speaks of as showing abnormally high loads, as compared with the others, and I was of the opinion that all junior colleges were the same in that respect.

While it is true that junior college engineering instructors deal almost entirely with the more elementary lower division subjects, such as mathematics, physics, surveying, drawing, etc., it is equally true that, to do a good job, just about as much time must be spent on preparation as for the upper division courses. One university professor of chemistry of my acquaintance, who has taught freshman chemistry for years, still makes complete rehearsals of his demonstration experiments part of his preparation for each lecture. The junior college teaching load should not be, therefore, and it does not, on the whole, appear to be, any higher than those in the

senior institutions; at least than for those university instructors who are not engaged in research or in outside professional work, such activities being neither expected nor provided for in the junior colleges, as far as I know.

While this paper shows a fairly satisfactory situation, as far as teaching loads are concerned, there is, however, an important factor in connection with junior college teaching, which might be termed the "teaching drag" of junior college instructors. I refer to conditions which are directly opposite to those in most of the four-year institutions, where, as a rule, every encouragement is offered faculty members in their efforts to improve their work and themselves. These conditions are brought about by the attitudes of the administrators and by the petty rules and regulations under which the instructors must work, due to the junior colleges in California being part of the secondary school system. This phase has not been a part of the present paper, but it deserves attention if engineering education is to be promoted wherever it is being attempted.

THE ENGINEERING EDUCATION CLUB AT ARIZONA

By JAMES C. CLARK

Some sort of live organization for the purpose of discussing the problems, large and small, of engineering education is desirable in any institution which maintains engineering courses of study. Naturally, at Arizona, the desire for at least something more of systematic discussion, if not for a definite organization has often been expressed over a period of many years. That the local "Engineering Education Club" is of such very tender age—only one year—should be regarded neither as evidence of unbecoming sluggishness in the past, nor of a wholly unwarranted snootiness, toward problems of education. The acceptance last year by the Pacific Southwest Section of this University's invitation to convene here this winter was not merely an occasion for rejoicing among local members of the S. P. E. E.; it furnished a most welcome incentive for the taking of steps toward the organization of what we term the "Engineering Education Club."

It was due to the enterprise of Dean G. M. Butler and Professor John C. Park that the first actions were taken a year ago which have led to the formation of the local Club. It was considered advisable at the outset not only to assume as members, automatically, all the teaching staff of the College of Mines and Engineering, but also to invite to all meetings any teachers of mathematics, physics, chemistry, English, and economics who cared to come.

Even the preliminary committee named by Dean Butler for the purpose of investigating the desirability and feasibility of forming an organization included among its membership of four men, two from outside the Engineering College. Professor Park gathered, by the questionnaire method, a variety of data from all those who might be interested, and the preliminary committee digested these data. By this process, it was found that certain rather clearcut features should characterize the organization; namely:

1. Some sort of organization was considered desirable.
2. Frequency of meetings should be once per month.
3. Meetings should include a dinner at a moderate cost.
4. Meetings should begin promptly at 6 P. M. and adjourn promptly at 8 P. M.
5. No dues should be collected.

Naturally, some arrangements were left to the organizing committee to be perfected. Others were deferred by the committee to be settled at the first dinner meeting, such as the most suitable day in the month to meet. Officers elected at the first meeting were; Chairman, J. C. Clark; Vice-Chairman, M. L. Thornburg; Secretary, O. H. Polk; Treasurer, W. C. Currie. The term of office is throughout one calendar, not academic, year. The officers constitute an executive committee.

Five meetings of the "Engineering Education Club" have been held, three during the spring and two during the fall, of 1936. The average attendance has been 27, with a minimum of 23 and maximum of 31. The faculty of the College of Mines and Engineering have supported the project with enthusiasm. The interest shown by men from non-engineering departments has also been most gratifying. At the first meeting there were three present from mathematics, two from English, two from economics, one from chemistry, and one from astronomy. The most recent meeting was attended by six from mathematics, one from English, three from economics, one from chemistry, and two from physics.

The questionnaire prepared by Professor Park elicited many most interesting suggested topics for discussion. Working largely from these, and accepting practically entire responsibility for his choices of speakers and subjects, the Chairman decided that it would be a promising plan for most of the earlier meetings to consider a single important non-engineering subject of the curriculum at each meeting. Hence, at three successive meetings, one of the subjects, physics, English, and economics, was taken up at each meeting and discussed by a well-qualified speaker. Possibly the

most interesting meetings of the series were concerned with other matters. For example, at the first meeting in February, Dean Butler gave his paper which he had shortly before presented at the Stanford meeting of the section, in December, 1935, on the question "Should the Engineering Curriculum be Lengthened?" Most of the Club were rather unfamiliar with Dean Butler's arguments for the longer curriculum and the paper proved intensely interesting. The last meeting of the 1936 series was devoted to the topic "Personality in Engineering Students." Professors F. C. Kelton and M. L. Thornburg each spoke most edifyingly on this subject.

Experience in conducting the dinner-meetings of our Arizona Club shows clearly that the only real difficulty lay in the fact that there has been almost no time available at any meeting for general discussion of papers. This is a serious difficulty since the free, unhurried interchange of thought is a valuable product of meetings of this kind. On the other hand, the fact that the meetings adjourn promptly at eight has been an advantage, doubtless, as a factor in bringing out good attendance at the meetings. For many individuals, the termination of the meeting at eight has made it possible to attend other meetings on the same evening. It seems necessary to continue to hold meetings in the evening. Class and laboratory schedules at the University of Arizona provide only an hour in the middle of the day, thus rendering luncheon meetings impossible if papers are to be presented. Possibly a solution of the problem consists simply in continuing the informal discussion beyond eight o'clock for those who find it possible to remain.

Speaking not only for myself but venturing to speak for others who have expressed their thoughts on the matter, the meetings have afforded a much-needed means at Arizona for some approach to the clarification of ideas on engineering education. They have also provided additional very welcome opportunities for assembling in a pleasant atmosphere those faculty workers whose paths are too prone to diverge widely when each is ardently devoted to that work which, to him, seems all-important. Under the leadership of Professor John C. Park, true gentleman, earnest student, and capable engineer, the Club anticipates for 1937 a most successful year.

FACULTY ADVISERS FOR JUNIOR COLLEGE AND UNIVERSITY STUDENTS

By H. B. WALKER

University of California

My topic is not new. For several decades it has been the subject of discussions in our Society and the inspiration for numerous committee reports, all of which have been fruitful, and in keeping with the objectives of our organization. This is the type of problem which will be with us as long as we have students and, therefore, it is legitimately a continuing topic.

The guidance of students is an accepted responsibility among all teachers who have a professional attitude toward their life work. It is a continuous procedure starting with the student in the kindergarten and proceeding through the grades, high school, junior college and terminating in the University. In this respect it is, and should be, a coördinated as well as a coöperative enterprise fitted at all times to the intellectual capacity and changing maturity of the student.

Our particular responsibilities start with the College or University freshman and continue as long as the student remains in academic training. A review of the literature of our Society reveals a wealth of material on this general subject which merits the close study of all engineering instructors. For the purpose of this paper it seems appropriate to limit the discussion to undergraduate students in Junior Colleges and Universities.

The engineering profession should consider itself fortunate in having definite objectively planned curriculi for the training of men for the various branches of the profession. Moreover, in these various branches it is still more fortunate there is so much in common, particularly during the first two years of collegiate training.

The general objectives of engineering training have been very well expressed * as (*a*) "a mastery of those principles and practices which characterize the differentiated fields of engineering," (*b*) "a discipline in those ideals, attitudes, habits and skills which are distinctive of engineering thought and work," and (*c*) "the development of a cultural and economic background from which the engineer may understandingly find his own position in relation to society and its problems, and build a philosophy of life."

In other words, the engineering profession knows rather definitely the directional tendencies of its educational programs; it

* Rogers, H. S., "Objectives and Methods of Training in Civil Engineering," Jour. Engineering Education, Vol. XXVI, No. 6, p. 446, February, 1936.

has a very good conception of the specific academic requirements and there is fair agreement as to the time which can be profitably spent in undergraduate preparation for professional life. These factors are all favorable for sound professional advancement. Obviously, the tangible method of procedure is most likely to attract the type of mind desired as new material for professional maintenance and growth.

It might be profitable to think of the raw material seeking engineering training in terms of a group to discover if there might be some common characteristics predominating. The suggestions which follow are based upon observations and experiences rather than factual data.

(1) The entering freshman has a good general conception of the undergraduate course requirements for training an engineer.
(2) He is interested in dealing with tangible values and has an inherent interest in mathematics and the physical sciences.
(3) His conceptions of personal integrity are well developed. He is reasonably honest with himself.
(4) His interest in engineering is based upon the hope of attaining professional recognition, coupled with the opportunity to earn an honorable livelihood.
(5) He hopes eventually to establish a home for himself.
(6) He is not a radical or a reformer.
(7) His interests are definite and his program is definitely arranged, which tends, incidentally, to promote among others the prevailing idea that engineering students have narrow outlooks on life.

It cannot be said that these characteristics are common to all engineering students, because it is well known there are exceptions, and unfortunately, it is quite often the exceptions which require the most guidance and the most time of advisers.

The character of guidance for optimum student development is hardly capable of standardization and must be variable in its nature. The shy inexperienced or the more bold, sophisticated freshman presents a different problem than the seasoned senior. It is the difference between the raw product and the more finished material. Moreover, with the raw product we are apt to receive material unsuited to the requirements of our market, so that rigorous inspections and tests must be made to eliminate unsuitable material before the more expensive finishing processes are undertaken.

It is true also that in educational construction the materials with which we fashion the finished products are homogeneous only so far as general outward physical appearances are concerned.

Students, when it comes to native ability, interests and emotional responses, are quite heterogenous. If we look into our teaching programs, however, it would seem possible to arrive at some logical procedure as to responsibilities in student advising. This, of course, indirectly implies certain qualifications upon the part of the adviser.

The lower division student is concerned first of all with the mastery of principles, and the success he attains in this depends primarily upon his native ability and industry. There are certain rather rigid requirements he must meet to complete successfully, this part of his training. His performance in mathematics, chemistry and physics are excellent criteria of native ability when coupled with appropriate appraisals of industry. The high school record of the properly matriculated student is helpful principally for correlation purposes. Certain intelligence tests provide helpful data for those who may develop as border line students. When we take into account that the student's program in engineering is well established and that numerous reliable criteria are available to appraise his intellectual capacity, this part of student advising becomes relatively simple and, in general, quite well met. We seem to have a fair supply of instructors capable of advising students in the matter of course sequence and basic subject matter as such.

These things, in themselves, do not constitute adequate guidance for engineering students, and this is perhaps the crux in our advisory systems. Students require certain discipline of thought and action to develop themselves for their chosen field. The student must be able to organize his own mental resources and, to utilize these most effectively, involves the early development of effective study methods. A very large number of students require guidance in study methods in order to develop economy of effort in learning. Students need guidance on, budgeting of time; how to take notes; how to utilize the library; how to concentrate and on procedure in reasoning.

The budgeting of time is essentially the primary step in such guidance. The engineer is concerned always with the most effective use of the materials with which he works and, for the first year college or university student, his own intellectual capacity coupled with the time available for intellectual endeavor constitute his most valuable resources.

Time budgeting for students is quite generally recognized as one of the most valuable helps in student advising. It is a personal matter, more or less, and it is most effective with the student when it is treated as such. The use of the lecture system for freshman week and non-credit orientation courses as a mass method of

student guidance is not without its value, but it has very definite limitations unless supplemented by well organized counselor or adviser systems.

Probably the greatest obstacle to student progress during the lower division training period is the lack of engineering motivation in the theory courses, which constitute such an important part of the student's schedule. Motivation implies creative interest and, with interest there is stimulation for study, collateral reading and better use of time. Most of the senior members of our Society recall the numerous discussions arising from time to time in the teaching of mathematics, English, economics and chemistry, and the frequent use in many institutions of such descriptive terms as "engineering English," "engineering economics," etc., prompted no doubt from the recognized need of student motivation. One of our members * expressed this need, indirectly, when he stated in effect: "What we teach should be important but it is also important to know how and when to place emphasis on what we teach."

With a close coördination of teaching work which now seems both logical and possible between instructors of engineering students at the several institutions and through the media in our national organization, motivation through the basic theory courses should become a developing reality, and with this student orientation should develop into a more natural and logical procedure without the need of special orientation courses. This desirable arrangement would make it possible for the student to effectively concentrate on his major theory courses thus contributing to more effective teaching as well as less confusion for the student due to fewer courses and instructors. It would seem a worthy objective in the training of engineering students to think more of the methods of motivation of students in the basic courses, rather than to tresspass upon the valuable time of undergraduates with special orientation courses. This need not interfere in any way with extra-curricular activities of a professional nature, which are valuable in developing the student and which have great value in developing student ideals and attitudes toward the engineering profession.

A personal adviser system is a necessity and extremely valuable. It may not be so important as to the exact personnel methods used, such as whether or not these should be assigned staff members, or specially selected advisers, or some personnel officer, so long as the student has some one to whom he can and will go

* Connelley, J. R., What a Youngster Thinks of Engineering Education," THE JOURNAL OF ENGINEERING EDUCATION, Vol. XXVI, No. 8, pp. 653–655, April, 1936.

willingly for personal assistance. If it is only a matter of schedule, or course sequence, or perhaps a budgeting of his time for more effective study methods, any engineering instructor should be mentally capable and adequately qualified to render a valuable and usually an acceptable service, for in these things, one is dealing in tangible values. But in the less tangible matters involving emotional maladjustments such as homesickness, emotional immaturity, feelings of inferiority, conflicts relating to family life, financial difficulties, religious and moral problems, love experiences and sex, the student will be reticent to confer with anyone other than some person who commands or wins his confidence. Usually this will be one of the older members of the staff gifted with the faculty of knowing when and how to be sympathetic without becoming paternalistic; who can treat real and imagined problems understandingly, and who can at the same time build up a more self-reliant student. The engineer must be self-reliant and there is some danger of undermining student self-reliance by paternalistic advisory system.

Frequently, there are cases requiring clinical attention * because of emotional maladjustments. For the most part these cases are not general, and in a well-organized institution, such should be referred to proper specialists for attention or assistance as the case may warrant.

One's first reaction to any adviser system is that it takes a lot of time and may seriously interfere with teaching and research programs. On the other hand, if we break it down into its various elemental phases it would seem possible to make it effective without undue burdens. Let us consider the following as a suggestive procedure:

(1) Every instructor of engineering students by reason of the nature of his work is an adviser so far as his own subject matter is concerned.

(2) Every engineering instructor should be qualified to advise students in matters of course sequence particularly in the curriculum he represents, and as such, he is automatically and logically qualified as course adviser to students. This should carry with it the responsibility of assisting students in time budgeting, study habits, and such other routine help as is more or less common to the normal student. He should be encouraged through general faculty organization to develop himself as an adviser, and he should use every possible means of gaining the confidence and respect of the student. In this, however, he may be handicapped by person-

* Cleeton, G. V., "Clinical Treatment of Maladjusted College Student," THE JOUR. OF ENGINEERING EDUCATION, Vol. XXV, No. 6, pp. 405–410, Feb., 1935.

ality, age, time or interest. However, these do not constitute logical handicaps. A true teacher should have an agreeable personality. He should be the type capable of being or becoming an adviser. He should be interested in the welfare of potential engineers. If he is young his colleagues should be interested in his development as an effective teacher. If time is not available for such duties it is not the fault of the teacher but the shortsightedness of the institution in which he works. Any institution which overworks its instructors, not only cannot hope to adequately advise its students, but it cannot expect to do effective teaching.

(3) A well developed plan should take into account special advisory services which may require properly qualified personnel of high professional grade and maturity. A group of counselors could very well be provided, something after the plan of Iowa State College.* Under this plan it would be practicable to make a counselor responsible for a group of engineering teacher-advisers with a close coördination of duties within the group, and with the understanding that the advisers should send students on to the counselor, whenever the importance of the problem would seem to justify, such as, misunderstandings between an instructor and student, professional interests which may require the attention of a mature man, cases of emotional maladjustment, etc. These counselors should be carefully selected. They might be department heads or full professors and if a choice is possible preference should be given to those having a demonstrated interest in students and their problems, and who are capable of approaching their problems with a judicial viewpoint.

(4) The advisory system should extend beyond the counselor. Unusual problems may require executive attention from heads of departments and deans, or if certain clinical problems are involved the cases may merit the attention of appropriate specialists.

Such a program may not seem to be practical for junior colleges. On the other hand, it is a system which is readily integrated with sound teaching programs with the major responsibility placed upon the engineering faculty where it rightfully belongs. It does not involve the development of a highly specialized advisory personnel involving expertness other than a professional teaching attitude.

The real problems of engineering training are qualitative rather than quantitative. With rather uniform agreement on subject matter, it is to be assumed that entering students are not entirely ignorant of academic requirements. There is no particular need of selling engineering training by trying to attract students who

* Stewart, L. O., "The Counselor System at Iowa State College," Jour. of Engineering Education, Vol. XXI, No. 7, pp. 507–511, March, 1931.

are not normally interested. Once students are interested and committed to an engineering program it is the duty and the responsibility of engineering faculties to give serious thought to productive guidance directly through their own courses and indirectly through coöperation with teachers in related courses, such as mathematics, physics, etc.

The responsibility if made a part of engineering teaching is not only consistent with good pedagogy, but it is helpful to the instructor, and makes unnecessary highly specialized and often expensive personnel departments.

Discussion

By THOS. C. McFARLAND

I have read Professor Walker's paper with a great deal of interest, and I am completely in accord with his views. The following brief comments of mine are from observations that I have made over a number of years and relate primarily to the problems which make an advisory system necessary, as well as to the qualifications of a good adviser.

Advising of students becomes necessary because of several factors. Perhaps the most important of these factors are: (*a*) problems arising from the administration of curricula, (*b*) problems of adjustment to a new environment, (*c*) problems of self-discipline, (*d*) problems arising from personal difficulties, (*e*) problems arising from planning the future.

In the administration of curricula in all colleges and universities it is found necessary to specify prerequisites for certain courses. The entering Freshman should meet definite requirements in mathematics, drawing, and the sciences before he can begin an engineering curriculum. Before advancing to the second year's work he must have completed additional subjects which are fundamental to the work of that second year. Before proceeding to the third year's work he must have satisfied additional prerequisite work in his second year. A successful curriculum must build upward in this fashion from a proper foundation. *An important function of an adviser is to check with each student in regard to prerequisites.* No special qualifications are needed by the adviser for this other than a knowledge of the sequence and content of courses, and an appreciation of the importance of a proper sequence.

All engineering curricula specify a certain number of hours or units of work to be taken. This number represents sufficient work to keep the average student well occupied. Occasionally, there are

exceptional students who are ambitious and want to take more than the specified number of units. Frequently, students who are earning their living expenses, in whole or in part, desire to take less than the specified number. Also there is the student who has an eye to extra-curricular and social activity and desires to take a minimum schedule so that his studies will interfere as little as possible with his activities. And then there is an occasional student who, by dint of some specialized training (such as trade school), has a superiority complex, and feels that certain required courses are quite unnecessary in his case. In all of these cases *the adviser must possess an understanding of human nature* in order to act judiciously. The ambitious student and the self-supporting student should be advised alike against injuring their health. Oftentimes the student who desires to take extra work has no "outside interests." To him the adviser should emphasize the importance of a well-rounded life, the ability to "get along" with people, the necessity of selling himself, etc. On the other hand the student who comes to college for the extra-curricular activities is probably quite certain that his future success depends mainly on knowing the right people, so he intends to learn just enough engineering to "get by." To him, and also to the student with the superiority complex, the adviser should point out that "a little knowledge is a dangerous thing."

Many college students and the majority of university students find themselves in a new environment. They are living away from home for the first time, and are confronted with responsibilities they never experienced at home. There are physical adjustments to be made that involve different time schedules. There are social adjustments to be made at the rooming house, the boarding house, the fraternity, or the dormitory, as the case may be. To those students who are shy, or have inferiority complexes, these adjustments may prove very difficult. If there is no one to whom they can turn for advice they will become homesick, and will do inferior work as a result. *The adviser should be able to judge personalities* so that he will recognize individuals of a retiring nature and can invite their confidence.

The conduct of classes is different in different schools. In the high schools the recitation system is used almost universally. In the colleges and universities, depending on the size of classes, either the recitation system or the lecture system may be used. When the change is made from a recitation system to a lecture system many students will find it difficult to become adjusted. Where they formerly had definite textbook assignments they may now have no definite assigned reading—merely references. It is difficult for many to realize that they are no longer being "spoon-

fed"; that they are expected to reason and not merely memorize; that they are expected to exercise initiative and follow up suggestions that come from the lectures. Usually, it is when students arrive at the upper division of their collegiate and university course that this adjustment has to be made. *The adviser should anticipate the student's adjustment* problems and warn him beforehand. In the long run much time and effort will be saved, both for the student and the faculty.

Many students are lacking in self-discipline. This is largely the result of previous home training. Things were made easy for them. There were no definite duties connected with early adolescence. Time was of little consequence. As a result, when they are thrust into a college curriculum that demands precision, order, promptness, neatness, and reliability they are at a loss as to how to proceed. Their study habits are ineffective. They do not know how to budget time. They cannot separate the essential facts of an assignment or a lecture because they cannot read and listen effectively. They can do none of these things because either they lack the will to do them or they have never practiced the steps that make for proficiency. *The advisor should explain the scientific method* of analyzing a problem and advise students regarding the use of libraries, the budgeting of time, the recording of information, and the analysis of problems.

Some students have to acquire an education under a severe handicap. At a time when they should be giving their undivided attention to their studies, distractions are forced upon them by financial difficulties, by broken family ties, or by personal emotional adjustments. When these distractions persist they become the major force and the studies are gradually put aside. Such students usually realize their plight, and many are helpless to continue the struggle alone. They need some one to whom they can turn for fatherly advice; some one to whom they can unburden themselves and thereby let down the tension. To handle such problems as these *an adviser must be one of considerable experience in handling personal affairs, he must invite confidence, he must be sympathetic but also firm, and above all he must be tactful.* The advisor who handles such problems must have an office to himself. No student will unburden his soul when some one not particularly concerned is listening in.

Problems of planning the future fall naturally into two classifications. One class involves the student who is succeeding with his courses, the other concerns the student who is failing or just "getting by." Each involves making a decision regarding a choice between alternative goals. The student who is succeeding is usually concerned with such questions as: Should I go into a

small concern or a large concern? Should I go East or can I do just as well in the West? Should I prepare for teaching or should I plan to go into industry? Should I take graduate work, etc.? The student who is failing wants to know whether he should continue to struggle for a degree or should immediately withdraw and go to work, or enter a trade school. To the latter the issue is of far greater significance than it is to the student who is succeeding, for a decision to give up the struggle will often be regarded by the student as an admission of failure—and that hurts. The adviser must exercise the maximum of tact and diplomacy in such cases. He must stress the fact that it is far more praiseworthy to take a new path when one comes to a stone wall over which he cannot climb than it is to keep butting the wall. He must point out that the possession of a college degree is by no means the only "open sesame" to success. In all these cases *the adviser must lead the student, by suggestion, to make his own decisions.*

Summarizing, it is seen that an adviser must possess an interest in human problems, must have had considerable experience in judging individuals, must invite confidence, must be tactful, sympathetic and considerate, yet firm, and must be possessed of infinite patience. The obvious conclusion is that advisers should be members of the faculty and not students from the regular student body.

NEW MEMBERS AND DIVISIONS

ANDERSON, C. ALBIN, Instructor in Drafting, Lewis Institute, Chicago, Ill. D. C. Jackson, Jr., R. B. Parks.

BRADT, WILBER E., Professor of Chemistry, University of Maine, Orono, Me. W. J. Creamer, W. E. Barrows.

CALVERT, JOHN F., Associate Professor of Electrical Engineering, Iowa State College, Ames, Iowa. H. W. Anderson, F. H. McClain.

CARDIN, C. J., Professor of Pre-Engineering, North Central College, Downers Grove, Ill. W. H. Seegrist, S. F. Bibb.

CARLTON, ERNEST W., Professor of Structural Engineering, Missouri School of Mines, Rolla, Mo. H. H. Armsby, F. H. Frame.

CLOWER, JAMES I., Associate Professor of Machine Design, Virginia Polytechnic Institute, Blacksburg, Va. L. O'Shaugnessy. J. B. Jones.

DODGE, BARNETT F., Professor of Chemical Engineering, Yale University, New Haven, Conn. Roscoe H. Suttie, Philip G. Laurson.

DOUGLASS, RAYMOND D., Associate Professor of Mathematics, Massachusetts Institute of Technology, Cambridge, Mass. C. E. Tucker, A. L. Townsend.

DUNCAN, GEORGE W., Instructor in Mechanical Engineering, Los Angeles Junior College, Los Angeles, Calif. John W. Hazen, Clarence E. Guse.

DUNLOP, JOHN A., Instructor in Civil Engineering, Rensselaer Polytechnic Institute, Troy, N. Y. Ray P. Baker, H. O. Sharp.

FORMAN, ALEXANDER H., Professor of Electrical Engineering, West Virginia University, Morgantown, W. Va. G. P. Boomsliter, L. D. Hayes.

GALLIGAN, WILLIAM E., Assistant Professor of Civil Engineering, Iowa State College, Ames, Iowa. A. H. Fuller, R. A. Caughey.

GRANT, HIRAM E., Instructor in Drawing and Descriptive Geometry, University of Wisconsin, 623 W. State St., Milwaukee, Wis. Ben G. Elliott, H. D. Orth.

JAMES, R. V., Professor and Head, Department of Mechanics, University of Oklahoma, Norman, Okla. Homer L. Dodge, F. L. Bishop.

KARSTEN, ANDREW, Professor of Chemical Engineering, South Dakota School of Mines, Rapid City, S. D. Carl G. Watson, E. E. Clark.

KNIGHT, FLOYD C., Instructor in Mechanical Engineering, Case School of Applied Science, Cleveland, O. F. L. Plummer, G. E. Barnes.

KOLB, WILLIAM K., Vice-President of Sales, Gilson Slide Rule Co., P. O. Box 134, Newark, N. J. J. A. Weishampel, R. W. Van Houten.

LAMB, JOHN F., Instructor in Electrical Engineering, Carnegie Institute of Technology, Pittsburgh, Pa. A. D. Moore, Wm. R. Work.

LARSON, LUDVIG C., Assistant Professor of Electrical Engineering, University of Wisconsin, Madison, Wis. Ed. Bennett, E. D. Ayres.

MACQUIGG, CHARLES E., (after July 1, Dean of Engineering, The Ohio State University, Columbus, Ohio), 30 E. 42d St., New York City. C. E. Davies, G. A. Stetson, C. B. LePage.

MARCO, SALVATORE M., Instructor in Mechanical Engineering, The Ohio State University, Columbus, O. F. W. Marquis, S. R. Beitler.

MCNEW, JOHN T. L., Professor of Highway Engineering, A. & M. College of Texas, College Station, Texas. H. C. Dillingham, N. F. Rode.

MOLSTAD, MELVIN C., Assistant Professor of Chemical Engineering, Yale University, New Haven, Conn. R. H. Suttie, P. G. Laurson.

PANUSKA, FRANK C., Administrative Assistant, Stuyvesant High School. 3346 98 St., Corona, N. Y. C. E. Davies, C. B. LePage.

PIERCE, STANLEY H., Instructor in General Engineering Drawing, University of Illinois, Urbana, Ill. R. P. Hoelscher, H. H. Jordan.

PIPES, LOUIS A., Instructor in Electrical Engineering, Rice Institute, Houston, Texas. J. H. Pound, J. S. Waters.

ROSE, LOUIS H., Associate Professor of Electrical Engineering, University of Dayton, Dayton, Ohio. B. T. Schad, U. J. Rappel.

ROYS, HARVEY C., Assistant Professor of Physics, University of Oklahoma, Norman, Okla. Homer L. Dodge, F. L. Bishop.

SHERMAN, OREN G., Assistant Professor of Thermodynamics, Lewis Institute, Chicago, Ill. F. A. Rogers, R. B. Parks.

SHIELS, K. G., Assistant Professor of Drawing and Descriptive Geometry, University of Wisconsin, Madison, Wis. A. V. Millar, H. D. Orth.

SHOREY, EDWIN R., Associate Professor of Mining and Metallurgy, University of Wisconsin, Madison, Wis. G. J. Barker, Jos. F. Oesterle.

SMITH, MERRILL J., Instructor in Physics, Los Angeles Junior College, Los Angeles, Calif. John W. Hazen, Clarence E. Guse.

SPARKS, OTHO O., Instructor in Architecture, University of Oklahoma, Norman, Okla. Homer L. Dodge, F. L. Bishop.

WEIDMAN, SAMUEL, Professor of Geology, University of Oklahoma, Norman, Okla. Homer L. Dodge, F. L. Bishop.

WILLIAMS, DAVID C., Instructor in Mechanics, The Ohio State University, Columbus, Ohio. Percy W. Ott, Samuel B. Folk.

WOLFE, CHARLES M., Instructor in Electrical Engineering, Armour Institute of Technology, Chicago, Ill. E. H. Freeman, H. T. Heald.

WRIGHT, HAROLD M., Instructor in Mechanical Engineering, Rensselaer Polytechnic Institute, Troy, N. Y. R. P. Baker, E. A. Fessenden.

Council has authorized the formation of a Mechanical Engineering Division, F. L. Eidmann, Columbia University, **Chairman,** F. D. Carvin, Newark College of Engineering, **Secretary.**

CORRECTIONS TO THE YEAR BOOK

The February issue of the JOURNAL OF ENGINEERING EDUCATION was the year book of the Society. The following corrections have been noted since its publication:

Armstrong, C. W., Cornell University.
Benèze, Stephen, instead of Beneze.
Butler, J. B., member since 1922, name should be added to Rolla, Mo., under Geographical Distribution.
Cheek, Frank J., changed from Kansas State College to University of Kentucky, Lexington, Ky.
Clousing, L. A., changed from Northwestern University to Naval Air Station, Pensacola, Fla.
De Baufre, W. L., Chairman, Department of Engineering Mechanics instead of Applied Mechanics and Engineering Drawing.
Fechheimer, Carl J., instead of Feichheimer.
Finnegan, J. B., omit Director, Research and Testing.
Furia, J. J., changed from Manhattan College to Secretary, National Management Council, New York City.
Hanrahan, F. J., changed from Pennsylvania State College to 1401 Columbia Road, N.W., Washington, D. C.
Kimbark, Edward W., instead of Edward U.
Koehler, W. A., Professor of Chemical and Ceramic Engineering instead of Chemistry.
Kolb, Robert P., Professor of Heat-Power Engineering instead of Aeronautical Engineering.
McKee, E. R., University of Vermont instead of University of New Hampshire.
Paslay, L. C., changed from Kansas State College to National Geophysical Co., Dallas, Texas.
Sabbagh, Elias M., instead of Sarbagh.
Spears, S. M., Associate Professor of Civil Engineering instead of Assistant Professor.
Yenni, W. H., changed from Lewis Institute to Technical Director, Joseph Weidenhoff, Inc., Chicago, Ill.

The following names should be removed from the list of members:

Black, H. H.,
Burns, F. J.,
Chapin, L. W.,
Drisko, W. J.,
Ekstrand, K. H.,
Gwiazdowski, A. P.,
Harlan, J. C.,
Jorgenson, L. M.,
Mitchell, Alva,
Newton, R. H.,
Owens, T. D.,
Roundtree, H. C.,

SUMMER SURVEYING CAMPS AND SCHOOLS IN THE UNITED STATES AND CANADA

By O. S. ZELNER

University of Minnesota

The report of the Committee on Summer Surveying Camps is presented. Starting in February, 1936, 191 institutions were contacted and replies received from 155, the response in nearly every instance being very gratifying. Tabulations of replies from seventy-one institutions having summer surveying schools or camps, with comments by the author, constitute the report.

The tabulations, in spite of careful checks on their accuracy, contain errors. These errors are sometimes due to misinterpretation of the questions by the man filling out the questionnaire, or of the answers by the writer. As examples, there is the confusion in the statements on "Camp tuition or fee," and on the year or years in which a student may be eligible for camp. However, for the most part, the records are not misleading, and as far as the Committee was able to determine, the report includes data from every recognized school having either a summer surveying school or camp.

This paper attempts to point out some of the outstanding facts that have come to the fore through a study of the mass of data that came in, in response to the questionnaire on the general subject of summer surveying schools and surveying camps.

After consideration it was decided to include in the data to be gathered, information on the summer surveying school held in general on or near the campus, in which all of the time for a considerable period is devoted entirely to surveying, as well as data on the summer surveying camps. This addition has proved to be one of the most enlightening phases of the study. There were questions of the subject matter to be taught, organization, length of the camp period, time of the year, living conditions and many others that have been discussed by the surveying instructors in our own camp work at Minnesota many times. Based on some of these primary ideas, a preliminary list of questions was prepared and submitted to my colleagues for criticism. By a process of elimination and addition, through the assistance of our entire staff and very valuable coöperation by Professor Rice, Chairman of

the Committee, the completed questionnaire was sent out early in February of 1936 as indicated.

As a preliminary to a discussion of Summer Surveying Camps, it seems advisable to say something about a few of the camps with which the writer is familiar.

The Minnesota camp is located on the sandy beach of a beautiful lake in Chippewa National Forest in Northern Minnesota, well protected from severe winds and shaded by the pine forest. The lake is about four by five miles in extent with two pine-covered islands so situated as to provide almost ideal conditions for problems in triangulation. With the Mississippi River entering from the northwest and flowing out from the northeast corner of the lake, there is afforded a fine opportunity for both soundings and stream measurements. The Soo line and Great Northern railroads, which are approximately one mile from camp, and the town of Cass Lake, only about 4½ miles away with a rather extensive train yard, provide almost ideal opportunities for track and yard surveys. The village of Cass Lake provides ample facilities for town surveys. Beyond the town is a wide stretch of rolling land with only scattering jack pines and hazel brush. This is the site of the railroad location surveys. For transit and plane table topography we have many miles of shore line and many more miles of wood trails, with sufficient other open country.

The fine layout Wisconsin has at Devils Lake, Iowa State on Rainy Lake, Michigan in Jackson Hole, Wyoming, and others are well known. The problem, however, of finding an ideal camp site is a difficult one, and it would not be amiss here to cite the specifications used when Professor Dodds of Iowa State set out to find a site for a new camp. I shall quote from his list of desired conditions, and follow with a partial description of the camp as it finally developed. His specifications are as follows:

1. A site where nature offers practically primeval conditions.
2. Unlimited area for all branches of surveying work.
3. Isolation—absence of social distractions and interruptions.
4. Accessibility—cost of transportation must be reasonable.
5. Topographic variety.
6. Water for culinary purposes.
7. Healthful surroundings.
8. Interesting natural environment.
9. Possible engineering inspection trips en route.

A careful survey of possible Iowa sites eliminated them as undesirable on account of limited area, restricted use, social distractions, and interruptions from visitors, and because the camp was wanted by each community purely as a commercial asset.

An investigation covering a number of years disclosed a site on the south shore of Rainy Lake, in St. Louis County, Minnesota, about thirty-five miles from the railroad at Ranier, which offered all of the attractions desired for the camp.

The region is uninhabited except by scattering fishermen and Indians. The woods are to a large extent untouched by the logger and the soil which is largely solid rock will never be plowed for agriculture. There is practically no limit to the area available for instruction purposes.

Since the site selected is thirty-five miles from town by water and there are no roads, isolation is complete. In spite of its isolation the site is easily reached from Ames.

The spot selected is surrounded by cold, pure, soft water, about one hundred feet deep. The water serves the camp for culinary purposes, for swimming, and for hydrographic work as well as for transportation. Boats are used for placing parties in the field, and the twice-a-week mail comes in over the water route.

The tents are pitched upon solid rock and anchored to trees and logs. The topography of the region is interesting geologically. One can find practically every variety of surface conditions except level land. From the standpoint of the land surveyor in a sectionized region, the topography is especially interesting. In the township where camp is located, not one section is regular. Each one has some one of its boundaries interrupted by water and the accompanying meander lines. The original bearing trees marked in the winter of 1883 are still standing or to be identified by their stumps or fallen logs.

An added advantage of the camp in Northern Minnesota is the opportunity for valuable engineering inspection trips on the way to and from camp.

So it was that the camp site at Brown's Bay on Rainy Lake came up to the specifications for a desirable camp site for Iowa State College and the camp was established there.

Michigan's camp in Jackson Hole, some seventy-five miles south of Yellowstone Park, is almost ideal for its purpose. It is located in a widening of the valley of Hoback River, a swift mountain stream carrying normally about 400 c.f.s. of water and incidentally, well-filled with mountain trout. The camp itself consists of several central buildings with separate houses for faculty and students. A small mountain spring with its pure cold water is piped through all of the buildings and houses, providing a fine gravity system water supply. Electric lights are provided throughout the camp, and shower baths are available in both the faculty and student portions of the camp. The rolling foothills and surrounding mountain sides provide ideal conditions for practically all kinds of surveying from triangulation down. Mountain scenery is observable in every direction, one of the most beautiful sights being the Grand Teton Mountain, highest peak of the Teton range.

The camp elevation of nearly 1000 feet more than a mile, insures the students of all the bracing air they can use.

So much for some of the camps we know about from personal inspection.

The reports that have come in indicate that many schools have camps that approach ideal specifications. As a few examples that may be cited:—Carnegie Institute's camp on the Blackwater River near the top of the Allegheny Mountains in West Virginia, or Clarkson College of Technology at Potsdam, N. Y., with its camp reached only by a six mile boat trip, on a beautiful bay on Grindstone Island, one of the "Thousand Island" group near the head of the St. Lawrence River, or Cornell's camp on Lake Cayuga, made famous by Cornell's college hymn, "Far Above Cayuga's Waters," or Maine's camp on the Androscoggin River in the White Mountain National Forest, or Oklahoma A. and M. Camp on Eagles' Nest Lake in a national forest in the heart of the Rocky Mountains of New Mexico. The elevation of the last named is around 8000 feet and some of the days are so cool that students and faculty have to wear their winter underwear in June. Oklahoma travels 630 miles, crossing the Panhandle of Texas, to get to this site, but it certainly is worth it. The housing is in cabins owned by a fishing club.

We should not forget Purdue's splendid camp overlooking the Wabash River, made famous by Paul Dresser's song. Many of us enjoyed the fine hospitality of Purdue's camp in 1931 when the Society's meeting was held at Lafayette.

The University of Santa Clara, with its summer school in the valley of the same name, with San Francisco Bay for hydrographic work, is also splendidly situated. The University of Saskatchewan, having available, literally at its back door, open rolling prairies and the north branch of the Saskatchewan River, for its summer surveying school, is likewise almost ideally favored as regards site. Stanford, like Santa Clara, has rolling foothills, with lakes, and San Francisco Bay for its surveying school. And we shouldn't forget to mention the camp situated on an artificial lake, where the boys stand on the apron of the dam and use the overflow for their shower bath.

One of the most gratifying reports received was a very brief one from a school of which most of us have never heard, "Memorial University College" of St. Johns, Newfoundland. Professor S. J. Hayes, lecturer in engineering and a reader of S. P. E. E. publications, wrote Professor Rice, our chairman, asking for an opportunity to participate in the paper we were preparing. Professor Rice forwarded the letter to me and the report was included. His camp is located on Conception Bay.

The more prosaic side of camp data concerns the tabulations. First, the list of camps and schools show 54 camps and 19 schools. When the returns from Professor Clarence Johnston, head of the Department of Surveying at Michigan, were received, it was learned that the Michigan camp was started by Professor J. B. Davis officially in 1874. Professor Johnston, upon being informed that the Michigan camp had seniority rights, forwarded a brief history of the camp. Within a few days returns came in from Cornell stating that its camp was started in 1874, so Professor Underwood was asked for a brief history of the Cornell camp. Dartmouth's Thayer School has maintained a summer surveying school since 1871. The beginning dates of the camps or schools are apparently as follows: Dartmouth's Summer Surveying School—1871 instead of 1870 as the tabulation shows. The camps of Cornell and Michigan, 1874. These are quite closely followed by Columbia's camp of 1883 and California's camp of 1886. On the other end of the scale is a very promising record of eight camps started since 1930 and Missouri School of Mines, the University of the Philippines, University of South Carolina, Tennessee Polytechnic, Valparaiso University and the State College of Washington, planning to start camps as soon as possible. On the other side of the ledger is a record of discontinuances by the University of Akron, Alabama Polytechnic Institute, University of Delaware, Gettysburg College and Northwestern.

Chairman Rice was very much interested in one phase of campwork that may prove quite valuable. His opinion has been that if it were known that various camps could be reached more or less easily, and if provisions were available to accommodate visitors, many instructors of surveying could use the summer in making trips to other camps than their own, and thus broaden their experience of surveying instruction practice. Therefore, a question along these lines was added, and the information concerning locations, distances, and roads, and the information concerning accommodations for visitors are included. No doubt, advantage will be taken of the opportunities indicated.

The distances traveled to camp vary from about 10 miles, to well over a thousand. Michigan's trek from Ann Arbor to Jackson Hole leads with 1700 miles, with Oklahoma second with 630, and Iowa State a good third with 575 miles. Armour is fourth with 420 and M. I. T. with 335. The average is about 150 miles.

The table shows the length of camps and schools in weeks, and the periods occupied. There are four camps that run but one week and eight that run two. The longest camps are Columbia, Pittsburgh and Purdue, at ten weeks each, and seven other schools with eight weeks each. The mean length is 4.4 weeks.

Similarly other data have been summarized. Taking the columns more or less in their order, there are 23 permanent camps and 21 not permanent—some are semi-permanent; 8 is a minimum number of students, and 200 at Case School is a maximum. It should be indicated that in general the large number of students in camp is frequently the result of work being required for two or more years. In the instance just cited, Case required "all freshmen, and sophomore civils" to go to camp. (This requires some interpretation, and is an illustration of the errors that may be present due to my inability to correctly interpret the reply. It may mean sophomore civils and all freshmen of all departments, or all sophomore civils and all freshmen civils.)

The average number of students for all camps and schools is 32+. 1 is the minimum number of faculty men, and 28 is the maximum, with an average of just under four. The average ratio of faculty men to students is 1 to 8+. A rough summation indicates a total of about 235 faculty men and 2020 students in summer schools and camps each summer, which is quite an army. As concerns faculty, student and other housing, it shows 14 schools with faculty in tents, 19 in buildings and 4 in hotels. The same tabulation for students shows 20 in tents, 11 in buildings and 2 in hotels. In 8 schools the administration is housed in tents and 30 in buildings. For cooking and dining, 7 are in tents, 22 in buildings and 10 in hotels or boarding houses.

Most of the camps could accommodate visitors either in the camp or in hotels or cottages nearby.

Camp tuition varies from 14 schools with no fee to a high of $100.00. The average is somewhere near $20.00, but owing to complications of methods, the individual amounts are often hard to determine. Estimated total camp cost as shown in column 20, varies from a low of $10 and $12 a person to a high of $220. Tuition and length of the camp period are strong factors of course in the establishment of the total cost. In one or two cases, the cost is raised sharply because of the fact that the students are housed and fed in hotels or resorts.

The columns referring to student enrollment are mostly self-explanatory, but it might be well to point to the following in column 23, where it is indicated that 34 schools require students to go to camp after their freshman year, 27 after their sophomore year, and 3 after their junior year. There is basis for a lot of argument in that column.

Nearly all camps will accept students from other schools, but footnotes have also indicated that there are not many students that so apply.

The question of the complete rotation of students throughout camp, within parties, or no rotation at all, is always a fertile field for debate. At Minnesota, the entire camp is programmed every night, and complete rotation is maintained. A student rarely ever continues to work with another given student for a longer period than it may take him to progress through a four-man party, with one day on each individual job. If we find that two students are being accidentally programmed together for any considerable period, we arbitrarily separate them. 21 schools indicate partial or complete rotation and 30 with fixed parties, probably rotating within themselves. The problem of programming as we practice it at Minnesota means a lot of added work for whoever does the job. In our case all of the three faculty men work together on it. Again in the above tabulation, distinctions were not clear.

To simplify matters, the major subjects taught have been placed under four general headings,—Triangulation, Topography (any type), Hydrography (any type) and Route Surveying (any type). This tabulation shows 51 schools giving some form of triangulation, 53 giving topography, 28 hydrography, and 42 route surveying. Work with levels was practically universal, and work in precise levels is given in some schools.

Most schools do nothing with meteorological data. Eight schools keep quite complete records.

The question of outside work for state or federal branches, or for private interests, brought almost uniformly negative replies. Ohio is a notable exception and I believe a statement from Professor R. C. Sloane would be of value here. Ohio bases a very successful camp almost entirely on outside work as will be shown by the following quotation, which is given rather completely:

> This University has maintained a practical surveying camp since 1900. We do not maintain a permanent camp with buildings and accessories but make an effort to secure contract work for state, federal or other political subdivisions. We have been very successful along this line and very seldom are called upon to conduct a practice camp.
>
> On such a camp the students are organized into parties exactly as they would be in actual practice and the job is prosecuted with the same vigor a private employer would expect. Both students and faculty live in tents, the University furnishing beds, commissary and cooking equipment. A fee of $65.00 is assessed to cover all costs and any part of this fee not used is refunded to the student.
>
> On contract work any earnings of the camp are divided per capita among the surveying camp students after expenses have been deducted. The instructors are paid by the University and do not participate in the dividends. As an example, we have participated in the following surveys: road surveys, Yellowstone National Park, 30 miles of highways for

the state of West Virginia, 9 miles of railway location for the C. & O. railroad, 70 miles of highway for the state of Ohio, 100 miles flood surveys on the Susquehanna river for the federal government, 150 miles of river surveys of the Licking river in Kentucky, hydrographic survey of Buckeye lake, topographic surveys of state parks and forest reserves and many other similar jobs.

When we are not successful in securing contract camps we try and camp on some of the state reserves where we have ample room to lay out an entire project similar to one in practice and organize and work the project exactly as we would in practice. We believe this system to be much better than stated class room work. In addition, each student is required to make observations on polaris and the sun for azimuth and latitude. This is done on his own time entirely outside of working hours as designated in the earlier parts of this questionnaire.

Hoping that this gives you some insight into our system, I stand ready to furnish you any other information upon request.

(Signed) R. C. SLOANE,
Camp Director.

This material from Professor Sloane is one of the illustrations I have mentioned of the splendid coöperation of the schools contacted.

Some schools have gone quite far in the use of standard station plates for use in camp, particularly on triangulation and leveling. It is believed that the matter of inculcating into the minds of engineering students the value of permanent land marks has never been sufficiently stressed at educational institutions. It is believed further that if the educational institutions would set before the student good land marks in connection with student work, that this situation may be eventually corrected. The Committee hopes, as a result of this report, that other institutions may be encouraged to adopt a standard station plate similar in shape and design to those now used, so satisfactorily, by the Federal Surveying Bureaus.

It is believed also, that so far as feasible, all surveys should be connected to those of the Federal Government, including student surveys. A list of institutions not now provided with standard triangulation stations and benchmarks will be prepared and forwarded to the various Federal Bureaus engaged in surveying work, in the hope that as programs are made in the future, all engineering schools may ultimately be provided with standard marks.

The last three columns are concerned entirely with teaching policies. 12 have regular night work schedules. 40 have night work scheduled as needed, and 9 have none.

The subject of lectures is covered: 18 schools have regular lec-

ture periods, 24 have occasional lectures as needed, and 17 have none.

The last column is of vital interest to both students and faculty. It has to do with quizzes and final examinations. 16 have periodical quizzes, 17 have final examinations, and 31 have neither quizzes nor examinations.

Here are a few statements of added data which should be of general interest, and some of primary interest.

First. Boat Equipment. Many schools rent as needed, and many get along with row boats and outboard motors. The most complete equipment is probably at the Massachusetts Institute of Technology where they have three motor boats and several row boats. The inventories for the various schools run from nothing to $2,500.

Second. Structures such as tent floors, general buildings, etc., range from none to values up to $90,000 for large sets of buildings. There is every state of accommodation in between.

Third. Pumping plant, lighting plant and sewage system. Many have a single hand pump, some are so situated as to have running water through camp, as the University of Michigan, and some have power equipped pumping systems. Lighting systems range from kerosene lanterns and lamps, through gasoline lamps and lanterns to fully equipped electric lighting systems, and the range in sewer systems varies from the ordinary out house to a fully equipped sewage disposal system with filter beds, with values from a few dollars to an estimate of $5,000.

Fourth. Faculty housing. Many schools house their faculty in tents at a low cost, and as before, the accommodations range through barracks, dormitories, faculty-owned houses, to special buildings with an inventory of $4,000 to $8,000.

Fifth. Student housing varies almost exactly the same as faculty housing, with the tendency toward tents for students.

The total investment in permanent equipment and structures varies from nothing, in the case of institutions that lease an entire camp, to investments in several instances of $10,000 or more. Two schools between $10,000 and $20,000, two between $20,000 and $50,000, and two a little over $100,000.

A word should be said about the estimates of instructors as to the value of a summer surveying camp or school. The consensus of opinion in 25 cases, was "very essential," in 12, "essential," and in 6, "desirable."

Coöperative schools invariably do not use camps as a means of instruction, and several schools in the south and southwest because of conditions of the climate, can go into the field every month of the year. Hence they do not feel the need of a camp.

Most of those who recorded a preference, and practically every one expressed himself, wanted a camp at some considerable distance from the campus, with the facilities for hydrographic work and lakes or rivers for recreation. On the desirability of nearby railroads for instructional purposes, the opinions were about evenly divided.

In closing I wish to quote briefly from a few letters that came to me during the time I was engaged on this study.

The first is from Professor Underwood of Cornell.—

As I look back upon my own experience as a student it has always seemed to me that I learned much more about the use of surveying instruments during the month I spent at the Cornell Camp than I had learned in all my previous studies in surveying. The camp also seemed to give a good demonstration of the methods of certain phases of geodetic work, like triangulation, base line, and precise leveling. I am sure that most of our students, after attending camp, have much the same feeling.

There is also value to the student in working in an organization at camp which is somewhat similar to what might be expected in actual field practice in surveying. The student has an opportunity to become familiar to some extent with the relationship of one phase of the work with another, to see the necessity for control surveys, and to learn something of the methods of carrying them out, to study at first hand the relative merits of different topographic methods, like transit and stadia as compared with plane table, triangulation as compared with precise traverse, etc.

I might lay some stress also upon the value of summer camps as a means of getting the student better acquainted with his classmates and also in promoting a spirit of friendliness and coöperation between student and faculty. We should feel that our work in surveying would be greatly diminished in value if for any reason we had to give up our summer camp.

The second from Professor John C. Tracy of Yale.—

We feel that the Yale Engineering Camp plays an important part in our educational work with undergraduate students.

1. It enables us to give many courses during the summer vacation which otherwise it would be necessary to give during the regular college year and the time thus gained is of great advantage in planning our curriculum.

2. The subjects studied at the Engineering Camp can be taught to much better advantage in the uninterrupted periods that are available in summer but would not be possible during the college year.

3. The work at the Camp is not merely that of surveying. Much of the instruction usually given in such courses as highway engineering and railroad engineering can be carried on to advantage at the Camp in connection with the surveying. A considerable portion of each student's time

while at the Camp is occupied in classroom work as distinct from field work.

4. Life at the Camp, where the members of the faculty and students live together in such close relations, gives an opportunity for becoming mutually acquainted with each other. An esprit de corps is thus established which would be difficult to attain in any other way. We think it accounts to a large extent for the "family spirit" which seems to prevail among students and the faculty in our department of engineering.

Another from Professor Johnston of Michigan.—

It is my belief that all students of Civil Engineering should attend a summer surveying camp. The preparatory courses simply introduce them to field methods and students do not become proficient until they have been able to combine theory and practice in actual field operations. The civil engineer who is to continue to grow after he leaves the university must follow engineering opportunity as it is afforded. The leading civil engineers of the nation began their professional activities in the field and they have always kept in contact with data derived from surveys.

Students who attend the camp not only receive a rounded training in surveying but they also profit by the general experience of living and working together. A properly organized Camp affords valuable object lessons to thinking students. At Camp Davis we have gone a step further by affording students an opportunity to learn something about one of the most beautiful areas in the U. S. I believe that the experience that our students have at Camp Davis will make a lasting impression on them.

And last from Dean Leland of Minnesota.—

In my opinion, the summer surveying camp for civil engineering students affords practical experience of great value. The student who does not have the benefit of this experience is definitely weak in his surveying preparation. In addition to the application of the usual surveying methods to practical work on a field scale, not generally obtainable in the vicinity of the University campus, the work in camp provides useful contacts with problems of a practical nature connected with the handling of groups of men under field conditions, the tactful approach to strangers, and the association with other young men in well planned field projects.

I regard the summer surveying camp as an indispensable part of the civil engineering curriculum in every high-grade engineering school.

The histories of such camps and schools as Thayer School at Dartmouth, Cornell and Michigan are very interesting, and if desired will be made available.

Again I wish to express my appreciation of the kindness and courtesy of the many who furnished the information which made this report possible, and to express the hope that this review of summer surveying camp activities may prove to be of value.

Discussion

By L. E. GRINTER

Chairman, Civil Engineering Division, S. P. E. E.

This paper on summer surveying camps and schools deserves great commendation. It is most timely since a revision of curricula following inspection for accrediting is in progress at many institutions. Perhaps it is timely for another reason. A noticeable drift of students away from civil engineering and toward other engineering courses is in progress. The curriculum may or may not be at fault, but it will be studied all the more carefully because of this influence.

From a questionnaire sent to 191 institutions and answered by 155, 72 institutions submitted reports on surveying schools or camps. If it is assumed that all institutions having regular camps reported that fact, one concludes that about 33⅓ per cent of the engineering schools feel the need for and can finance summer surveying camps. This represents an important influence upon the civil engineering curriculum since the conduct of a summer surveying camp permits either an increased emphasis upon technical courses or a liberalization of the curriculum.

The "time honored" objections to summer camps are (1) that the vacation period taken away from the student reduces his earning capacity, tires him of school work, and thus forces many who would prefer to study civil engineering into other branches where a summer school is not required and (2) that some of the most difficult surveying is in cities rather than in primeval forests, that perfection in handling an instrument is not to be desired any more than perfection in wood-shop work, and that surveying is being overemphasized anyhow now that railway location is a thing of the past.

Those who would criticize summer camps must give pause, however, to consider the fact that one-third of our institutions maintain such camps often at great expense and that some camps have even been added in recent years. From the freedom which the summer camp permits the faculty in adjusting the four-year curriculum to meet the impact of new demands for more technical work and even greater liberalization, the writer appreciates its advantages. Such camps might tend to disappear if a lengthened curriculum were to be adopted, but they are likely to be maintained without question as long as the standard curriculum is continued at four years. In any event, this is one way in which a department can quite properly retain an individualism which may endear it to its students who, almost invariably, look back on "summer camp" as the unique experience of a college career.

BY PAUL P. RICE, CHAIRMAN, COMMITTEE 8, GEODESY AND SURVEYING

Through "A Study of Surveying Summer Schools and Camps," Committee 8—Geodesy and Surveying, presents its first report, data for which were gathered through Questionnaire No. 1.

The idea of such an investigation had its inception during the summer of 1932, when the Chairman of this Committee made an extended visit and inspection of the Summer Surveying Camp facilities of the University of Minnesota, at which time many of the problems presented in this paper were informally discussed with Professor Zelner and other members of the Minnesota staff. The creation of Committee 8—Geodesy and Surveying in the Civil Engineering Division, provided the means of undertaking such an investigation. Inasmuch as at least one course in Surveying is usually taken by all engineering students, and students in Mining Engineering, Forestry and Landscape Architecture take courses nearly comparable to those taken by Civil Engineers, the report is of wide reader interest to the members of the Society. In addition, the report contains considerable information of special interest to college and university officials who must consider the Summer Surveying School or Camp from the financial and administrative viewpoint.

No effort has been spared to make this report entirely complete and comprehensive. All member institutions of the S. P. E. E. were contacted until a definite response was received as to whether or not the institution maintained a Summer Surveying School or Camp. In a few instances, it appeared that questions were not properly interpreted, and for such cases institutions were again contacted to correct any apparent errors. It is, therefore, believed that this report includes accurate data from every Summer Surveying School and Camp now in operation in the North American continent north of Mexico, and for some of our insular possessions as well.

Grateful acknowledgment is made for the valuable contributions in this endeavor made by Dean O. M. Leland, and Professors A. S. Cutler and L. F. Boone, all of the University of Minnesota staff, who were not members of the Committee but rendered valuable service in connection with this investigation.

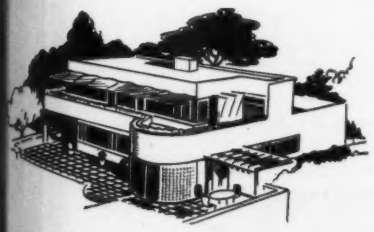
It is a real and genuine pleasure for the Chairman of this Committee to recommend this report to the Society's membership at large. Since this report is only the first of several which the Committee hopes to prepare in the future, it is hoped that its publication will induce a still greater coöperation between the Committee and the institutional members of the Society.

STUDY OF SUMMER SURVEYING SCHOOLS AND CAMPS IN THE UNITED STATE
S. P. E. E. CIVIL ENGINEERING DIVISION COMMITTEE NO. 8, SURVEYING AND GEODESY, I
O. S. ZELNER, UNIVERSITY OF MINNESOTA, JUNE, 1936

Institution	Camp or Summer School	Official Camp Name	Camp Location or Address	Date First Camp	Dist. to Camp	How Reached	Topography of Area	Camp or School Period	Camp Permanent	Camp Ownership	Average No. Students	Average No. Faculty	Student Assistants	Faculty Housing	Student Housing	Admin. Housing	
Alabama, Univ.	Camp		Varies		Max. 25		Rugged	First 3 wks. in June	Will be		30	2	2				
Alberta, Univ.	School		On campus			Hy. No. 1	Rolling. Saskatchewan Riv.	Month of April			100	3	1+2	(Staff)		College	
Alfred Univ.	School		On campus	1934			Rugged. Hilly. Small streams	Last 2 wks. June, 1st wk. July			85	6					
Arkansas, Univ.	Camp		Varies each year		±100		Small mts. Two good rivers	First wk. June	No	Var.	15	2	None	Tents	Tents	Tents	T
Armour Inst. Tech.	Camp	Armour	Trout Lake, Wis.	1914	420	U. S. 51	Rolling. Many lakes	Last 3 wks. June, 1st 3 wks. July	Yes	State	25	3	2	Ma. Bld.	Tents	Bldg.	B
Br. Columbia, Univ.	School		On and near campus	1918	Max. 10		Rolling. Gulf and Frasier Riv.	Last wk. April, 1st 2 wks. May			140	7					
Brown Univ.	Camp	Outing Res.	Greenville, R. I.	1930	11	Main hy.	Rough. On lake	Last 3 wks. July, 1st 3 wks. Aug.			8	1	1	1	Dorm.		
Bucknell Univ.	School		On and near campus				Rolling. Susquehanna Riv.	No report on dates					Set	Camp			
California, Univ.	Camp	C. E. Camp	Fairfax, Calif.	1886	21	Co. Rd.	Roll. Hilly. 3 W. S. Reservoirs	Last 2 wks. May, 1st 2 wks. June	Yes	Lease	135	6	6	7 tents	Tents	Bldg.	B
Carnegie Inst. Tech.	Camp	Surv. Camp	Davis, W. Va.	1912	140	Hy. 32	Mountainous—4 good rivers	Month of June, 1st 2 wks. July	Semi	Free	20	4	1	Hotels	Hotels		H
Case School App. Sci.	Camp	Case Camp	Waynesburg, Ohio	1907	75	Hy. 43	Hilly (200). No water near	First 3 wks. June	Semi	Priv.	200	28		Bldgs.		Bldgs.	B
Clarkson Coll. Tech.	Camp		Clayton, N. Y.	1927	87	Pvd. & boat	Very hilly. Isl. in St. Lawrence	Last 3 wks. Aug.	No		20	3	2		Tents	Tent	T
Clemson Coll.	Camp	Camp Clarke	Steedman, S. Car.	1928	118	U. S. 178	Rough (200). Small lake	First 2 wks. June	Yes	Coll.	25	1	1		(All in one	building)	
Colo. State Coll.	Camp	Eng. Field	Camp. Varies each year	1891	Varies	Various	Mountainous. Water various	Last 2 wks. Aug.	No	Free	50	3	Var.	Tents	Tents	Tent	T
Columbia Univ.	Camp	Columbia	Lakeside, Conn.	1883	90	Pvd. Rd.	Open. Rolling. 2 lakes	Months June, July, 1st 2 wks. Aug.	Yes	Univ.	65	3	4	Houses			
Conn. State Coll.	School		On and near campus				Rolling. Two small lakes	Last 2½ wks. June, 1st 2½ wks. July			25	2	1				
Cornell Univ.	Camp	Cornell	Odessa, N. Y.	1874	20	Pvd. Rd.	Hilly, mixed. On Cayuga Lake	Last 2 wks. Aug., 3½ wks. Sept.	Semi	Lease	35–90	6	1	Tents	Tents	Bldg.	B
Dartmouth Coll.	School		On and near campus	1870			Hilly	Last wk. Aug., month Sept.			10–15	2					
Detroit, Univ.	Camp	Surv. Camp	Oakland, Mich.	1925	45	U. S. 16	Rolling, mixed. On lake	First wk. July	No	State	15	2	No	Tent	Tents	Tents	
Duke Univ.	School		On 5300 acre campus				Rolling, mixed. Two rivers	First 3 wks. June			45	3					H
Ecole Poly.	Camp		Laval Co., Prov. Quebec	1930	10	Pvd. Rd.	Open, rolling. Riviere de Prairies	Last 2 wks. Sept.	Semi	Lease	75	11	None	(Drive out fr	om city d	ail	
Florida, Univ.	School	Summ. Camp	On campus	1935		U. S. 41	Rolling and flat. Lakes and rivers	Last 2½ wks. June, 3½ wks. July	No		20	1	1	Work out f	rom Univ.		
Harvard Univ.	Camp	Surv. Camp	Center Harbor, N. H.	1895	130	No. 25	Rugged. Squam Lake	Last 1½ wks. June, July, 2½ wks. Aug.	Yes	Sch.	25	1	2	Tent	Tents	Bldg.	B
Iowa State Coll.	Camp	Marston	Ranier, Minn.	1923	575	Pvd. & boat	Rough, rocky. Rainy Lake—Intl. bdry.	Month June, 1st 2 wks. July	Yes	Lease	40	3–4	1	Cabin	Bldgs.	Bldgs.	B
Lafayette Coll.	School		On and near campus			U. S. 611	Rolling. Hilly. Two rivers near	First 3 wks. June			15–25	3	None		Dorm.	College	
Lehigh Univ.	Camp	Surv. Camp	Canadensis, Pa.	1920	50	U. S. 611	Pocono Mts. Creek and lake	Month June, 1st 2 wks. July	No	Priv.	125	5	4			Hotels	H
Lewis Inst.	School		On and near campus				Rolling. Lake Mich. Des Plaines Riv.	Last 1½ wks. June, July, 2½ wks. Aug.		County	15–30	3	1				
La. State Univ.	School		On and near campus				Rolling. Lake and Miss. Riv.	Dates not given									
Maine, Univ.	Camp		White Mt. Natl. Forest		160	Pvd. Rd.	Mountainous. Androscoggin Riv.	Last 1½ wks. June, July, ½ wk. Aug.	No	Fed.	50	3	None	Tents	Tents	Tents	S
Manhattan Coll.	Camp	Eng. Camp	Raquette Lake, N. Y.	1899	310	U. S. 9	Mountainous. River and two lakes	Last 3 wks. June, ½ wk. July	No	Priv.	85	5	None	Hotel	Hotel	Bldg.	H
Manitoba, Univ.	School		On and near campus				Rolling and flat. Red River	Month of Sept.			98–38	3					
Mass. Inst. Tech.	Camp	Technology	E. Machias, Maine	1912	335	No. 1	Rolling. Lake, river, Atlantic Ocean	Last wk. July, Aug., Sept.	Yes	M.I.T.	35	3+4	Inst.	Bldg.	Bldg.	Bldgs.	B
Mich., Univ.	Camp	Davis	Jackson Hole, Wyo.	1874	1700	No. 187	Mountain valley. Hoback and Snake Rivs.	Last wk. June, July, Aug.	Yes	Univ.	26	6	1 or 2	Steel	Bldgs.	Bldgs.	B
Minn., Univ.	Camp		Chippewa Natl. Forest	1911	230	U. S. 2	Rolling. Cass Lake, Mississippi Riv.	Last 2½ wks. Aug., 3½ wks. Sept.	Yes	U. S. For.	45	3	1	Bldg.	Tents	Bldg.	B
Minn. Sch. Mines	Camp		Cuyuna & Mesaba Ranges	1896	225	Pvd. Rds.	Rolling. Lakes and Miss. Riv.	Month of May, 2 wks. June	No	Min. Co.	35	3	None		Hotel and B	ldg. Hou	ses
Mo. Sch. Mines	School		On and near campus			U. S. 63	Roll. to Precip. Creeks, 2 Rivs.	Last wk. May, June; last 2 wks. Aug., 2½ wks. Sept.	Semi	Sch.	150	4	2–4				
Mont. Sch. Mines	Camp	Survey Camp	Maidenrock, Mont.	1902	28	U. S. 91	Rolling and rough. Big Hole River	Last wk. Aug., 3½ wks. Sept.	Semi	Lease	35	1	2	House	Tents	Bldg.	B
Nebr., Univ.	Camp	Nebraska	Ashland, Nebr.	1929	30	U. S. 6	Flat to rough. Platte River	Month of June, 2 wks. July	Yes	Nat. Gd.	20	2	2	Tents	Tents	Bldg.	B
Nevada, Univ.	School		Rad. 30 mi. from campus	1900	25	Var.	Hilly. Near Truckee River	Last 2½ wks. May, 1½ wks. June			12–30	2	None		Colle	ege	
New Mex., Univ.	Camp	C. E. Field School	Chama, N. Mex.	1929	190	U. S. 285	Mountainous. El Vada Dam. Chama Riv.	Last wk. Aug., 1st 2 wks. Sept.	Yes	Univ.	25	2	1	Cabin	Bunk Hs.	Bldg.	B
N. Y., Coll. City	Camp		New York, N. Y.	1915	5	Pvd.	Varied. Hudson Riv. Park Lake	½ wk. May, June, ½ wk. July	Yes	City	160	4	1	(Go	out from	College d	ail
New York Univ.	Camp	Greenkill	Huguenot, N. Y.	1906	85	Pvd.	Rolling. Hilly. Lake and Delaware Riv.	Month of June	No	YMCA	55	4	1	Cabins	Cabins	Bldg.	Y
No. Car. State Coll.	Camp	Watts & Hoffman	Rougemont, Maysville		100	Var.	Rolling. Rivers. Near tide water	First 3 wks. July	Yes	U. S. For.	60	4	None	Bldg.	C.C.C.	Camp	B
No. Car., Univ.	Camp	Eng. Camp	Brevard, N. Car.	1922	300	Main hy.	Mountainous. Deer Park Lake	Last 2½ wks. June, July, 1½ wks. Aug.	Yes	Priv.	18	2			(Wooden	buildings)	
Norwich Univ.	School	C. E. Summer Sch.	On and near campus	1901		No. 12	Mountainous. Small river	Last 3 wks. Aug., 1½ wks. Sept.	No	Priv.	25–30	3	Var.	(T	ents whe	n in camp)	
Ohio State Univ.	Camp		No permanent location	1900	Varies	Varies	Varies	Last 2½ wks. June, July	No	Var.	30	3	None	(E	ntire cam	p in tents)	
Okla. A. & M.	Camp		Thurma, N. Mex.	1926	630	U. S. 64	Mountainous. Eagles Nest Lake	First 2 wks. June	Prob.	Lease	20	2	1	Lodge	Cabins	Bldg.	B
Pa. State Coll.	Camp	C. E. Surv. Camp	Bodines, Pa.	1920	86	No. 111	Broken. Two streams near	Last 2½ wks. June, July, 1½ wks. Aug.	No	Lease	40	2	Var.	(E	ntire cam	p in tents)	
Pa., Univ.	Camp	Cressbrook	Devon, Pa.		22	Hy. 83	Rolling farm. Schuylkill Riv.	First 3 wks. June	No	Univ.	15	2	0–3		Tents	Barn	T
Pittsburgh, Univ.	Camp	Hamilton	Windber, Pa.	1912	95	Main hy.	Mt. valley. Shade Creek	Last 2 wks. June, July, Aug.	Yes	Univ.	23	3	0	Perm	anent	Perm	an
Princeton Univ.	School		Princeton, N. J.	1886			Rolling	First 2 wks. Sept.			120	3	0				
Purdue Univ.	Camp	Ross Surv.	Lafayette, Ind., R.F.D.	1914	11	U. S. 52	River bluffs. Banks of the Wabash	Months June, July, 2½ wks. Aug.	Yes	Univ.	100	5	6	Cottage	(All	in Bldgs.)	
Rensselaer	Camp		Troy and E. Paultney		Varies	Varies	Green Mt. foothills. River and lakes	Last 2½ wks. June, July, 1 wk. Aug. (2 sessions)	No	Priv.	60	4		(Priv	ate Hous	es & Ho	te
Rutgers Univ.	Camp		Martinsville, N. J.	1934	13	Rd. 29	Rough, wooded, W. S. Reservoirs	Month of June	No	W. P. Co.	12	1	1	(Drive	from C	oll.)	
Santa Clara, Univ.	School		Santa Clara Valley	1935	Near		Valley and hills. San Francisco Bay	Last 2 wks. May, 2½ wks. June			10	1	None	(work	from ca	mpus)	
Saskatchewan, Univ.	School		On and near campus	1920			Rolling. N. Saskatchewan Riv.	Last 10 days April, 2 wks. May			75	5	4			College	
So. Dak. Sch. Mines	Camp	Keystone	Black Hills, Keystone, S. D.		20	No. 16	Mountainous. Mountain streams	Second week Sept.	No	Min. Co.	23	4	2	(Ca	bins)	Bldg.	P
Stanford Univ.	School		Vicinity of campus				Rolling, rugged. San Francisco Bay and lakes	Last wk. Aug., 3 wks. Sept.			10	3	Var.			College	
Stevens Inst. Tech.	Camp	Eng. Camp	Kittatinny Mts., N. J.	1930	62	3 hys.	Irregular, open. Glovers Pond	Month July, 2½ wks. Aug.	Yes	Inst.	150–210	6	4	Cabins		Bldg.	
Swarthmore Coll.	Camp		Nottingham, Pa.		50	U. S. 1	Rolling. Octoraro Creek	First week Sept.	Semi		15	2		Bldg.	Bldg.		S
Syracuse Univ.	Camp	L. Bonaparte	Lake Bonaparte, N. Y.	1920	100	St. hy.	Excellent rolling topography. Lakes near	Last 2 wks. Sept.	No	Priv.	60	4	1	(Hotel)		Ho	te
Toronto, Univ.	Camp	Gull Lake	Haliburton, Ont.	1920	125	Main hy.	Rolling, hilly. River and 3 lakes	Last 2 wks. Aug., 3 wks. Sept.	Yes	Univ.	40	5		Bldg.	Dorm.	Bldg.	B
Tulane Univ.	Camp	Summ. Surv.	Gurley, La.	1913	136	Rd. R.R.	Rolling. Small streams	First 2 wks. June	Yes	Lease	30	2	4	House	Tents	Bldgs.	
Utah Sch. Mines	Camp		Var. Mining camps	1900	40	Var.	Mountainous. Mountain streams	Months June and July	No	Min. Co.	10	1		(Min. Co.	Bldgs.)	(Mines	B
Vanderbilt Univ.	Camp	Bon Air	Sparta, Tenn.	1927	110	U. S. 70	Rough to rolling. Lake and stream	Last 2 wks. June, month July	Yes	Univ.	45	5	5		(Permane	nt bldgs.)	
Vermont, Univ.	Camp	Eng. Camp	Underhill, Vt.	1890	19	Hy. 15	Very hilly. Streams near	Month of June	No	Lease	25–30	3		Tent	Tents		H
Wash. Univ.	Camp		Wis. Minn. Colo. Mo. Can.	1896	Var.	Var.	Rolling. Rivers and lakes	Last 3 wks. Sept.	No	Var.	15–35	2	None		(Us	ually sum	mer resor
Wis., Univ.	Camp	Summ. Surv.	On Devil's Lake, Wis.	1910	40	No. 12	Hilly. Lake and two good rivers	Last 2 wks. June, 1st 2 wks. July	Yes	State	50	6	1	Sp.Tents	Tent	Off.Bldg.	
Worcester	Camp	Stephenson	Chaffins, Mass.	1904	4	No. 122A	Rolling. Stream	Last 3 wks. Sept.	Yes	Inst.	20	3	None	Tent	Tents	(Buil	di
Yale Univ.	Camp	Yale Eng.	Niantic, Conn.	1914	45	U. S. No. 1	Rough. Rocky. Powers Lake	First 3½ wks. June; last 3½ wks. Sept.	Yes	Univ.	85J, 30S	4	None	Bldgs.	Bldgs.	Bldg.	C
Marquette Univ.	Camp		Muirdale Park		6	Hy. 100	Rolling. Partly cleared	Second and third wks. June									
Memorial Univ. Coll.	Camp		Conception Bay, N. J.	1930	46	Bay Rd.	Rough. Conception Bay	Last 2 wks. Aug., 1st wk. Sept.									
Kansas, Univ.	Camp				±10		Rolling. Rough. No water	Month of June	No	Priv.	±30	±3	1	Tent	Tent	Tent	T
Schools	19			Ave.	150			Average Period 4.4 weeks									
Camps	54																
	73																

	Student Housing	Admin. Housing	Cook. Dine Housing	Housing Visitors	Camp Fee. Tuition	Est. Total Cost	Req. What Students	Eligible After What Year	Who May Elect	Outside Students Admitted	Field Parties Rotate—R Fixed—F	Triangulation	Topography	Hydrography	Route Surv.	Meteorological Observations	Work for State or Govt.	Work for Private	Working Radius	Transp. to Field Walk—W Auto—A Boat—B	Student Autos Allowed	Standard School Monuments	Govt. Monu. Available Triang.—T. Levels—L.	Scheduled Night Work	Lecture Periods	Quizzes—Q Final Exams—F
					$ 5.00		Civ. & Min.	2	Any	Yes	Var.	X	X	X				None		A	No	Yes	T–L			
		College			Incl.		Ch.E.E.	1–2		No						T.B.P.	Univ.		2	Walk			Yes	Obs.	Yes	On lect.
					21.00	$30.00	Civ. Min.	1			F		X		X				3					None	Yes	Final
	Tents	Tents	Tents	Tents	None	10.00	Civ.	2	Jrs.	No	R				X	None	None	None	2	Var.	No	No	L	Yes	No	None
ld.	Tents	Bldg.	Bldg.	None	55.00	97.00	Civ.	2	Any	Yes	Change	X	X		X	None	None	None	7	W A	Yes	None	T	Occ.	Occ.	None
							All Eng.	2			Change	X	X	X	X	None	None	None				None	Yes	Obs.		None
	Dorm.				48.00	90–100	Civil	1		No	R		X	X	X	No	None	None	3	W	Yes	Yes	L	Occ.	Yes	Q & F
								Soph.	Any	Yes																
s	Tents	Bldg.	Bldg.	None	20.00	55.00	Civ. Min.	1–3	Any	Yes	F		X		X	Occ.	None	None	2	W	Yes	Yes	No	Comp.	Occ.	None
	Hotels		Hotel	Hotels	27.00	107.00	Civ.	2–3–4	Any	Yes	R	X	X	X	X	None		Yes	3	W	Yes	Yes	No	Occ.	Occ.	2 exams
		Bldgs.	Bldgs.	None		52.50	Civ.	1–2		Yes	F	X	X	X		None	No	Yes	3	W	Yes		L	No		No
	Tents	Tent	Tent		30.00	50.00	Elect.	2	Any	Yes	R		X	X		Occ.			2	W	No rds.			Occ.	Reg.	Q & F
	(All in on	e building)		Yes	None	12.00	Civ.	2	Av. only	No	F				X	None	Limit	Limit	5	Truck	Yes	None		Limit		
	Tents	Tent	Tent	None	None	15.00	All	1, 2, 3		No	R						Limit	Limit	10	A, truck	Yes	None	No	No	No	None
s				Yes	None	100.00				Yes	F	X	X	X	X	Some	Yes	No	15	A	Limit	Yes	T–L	No	No	None
					20.00		All Eng.		Any	Yes														Limit	No	Q & F
	Tents	Bldg.	Bldg.	Hotel	None	60.00	Civ.	2	Yes	No	R	X	X	X	X	None	Yes	Rarely	6	A	Yes	Yes	T–L	2 hrs.	Occ.	None
					None		Civ.	3		Yes	R	X	X	X	X	None			3	Car, bus	Yes		L	No	Yes	Q & F
	Tents	Tents		None	4.00	29.00	Civ.	3	Limit	No	R	X	X	X		None	None	None	½	A	Yes	None	L	Limit	None	Some
			Hotel		25.75		All Eng.	1st	Any		R	X	X									Yes	T	Yes	Yes	Exam.
Dr	ive out fr	om city d	aily)		None		All Eng.	2 & 3		No	Both	X	X		X	None			1	A	Yes	None	N	Obs.	None	Yes
W	ork out f	rom Uni	v.		21.00	80.00	All C.E.	2	Any	Yes	F	X	X	X		Compl.	Univ.	No.	40	A	Yes	Yes	T–L	Obs.	Yes	Q & F
	Tents	Bldg.	Bldg.	Hotel	(Everything	150.00)	Elect.	1		Yes	R	X	X		X	None	No	No	1	W	Restrict.	No	N	Yes	Daily	Yes
	Bldgs.	Bldgs.	Bldgs.	Limited	27.00	100.00	All Civ.	2	Any	Yes	R	X	X	X	X	Compl.	None	None	3	W B	No rds.	Yes	Yes	Occ.	Yes	No
	Dorm.	College			20.00	45.00	Civ. Min.	1	Any	Yes	Both	X	X			None	None	College	1½	W A	Limit	Yes	T–L	Occ.	Occ.	Spec.
		Hotels	Hotels	Hotels	20.00 & 40.00	90.00+	All Eng.	1	Any	Yes	F	X	X		X	None	None	None	2	W	Yes	None	L	Yes	Yes	Q & F
					20.00		Civ.	1	ME, EE	Yes	F	X	X	X		None	None	Yes	12	A	Yes	City	Yes	Occ.	Occ.	No
									All Eng.	Yes														Obs.	No	exams
	Tents	Tents	Shack	Hotel	15.00	60.00	C.E. For.	1 & 2	None	Yes	F	X	X	X	X		None	None	Unlim.		Yes	None		No	Yes	No
	Hotel	Bldg.	Hotel	Cottage	60.00	90.00	All Eng.	2 & 3		May	Both	X	X	X	X	Precip.	None	Occ.	10	AB	Yes		T	Obs.	No	No
					17.50		All Eng.	1	None	Yes	F	X	X		X	None	None	None				None	N	Some	Reg.	No
	Bldg.	Bldgs.	Bldgs.	Yes	100.00	220.00	Civ.+	2–3–4	Any	Yes	Both	X	X	X	X	Some	None	None	40	BA	Limit	Yes	T–L	2 per wk.	Occ.	F
l	Bldgs.	Bldgs.	Bldg.	Bldg.	42.00	125.00+	Geo. & Surv.	1–2–3	Any	Yes	F	X	X		X	Yes	No	No	30	Truck	Yes	No	L	Obs.	Occ.	No
	Tents	Bldg.	Bldg.	Lim.	25.00	60.00	All C.E.	3	Any	Yes	R	X	X	X	X	Yes	Yes	None	10	WA	Yes	No	T–L	Yes	Occ.	No
Ho	tel and B	ldg. Hou	ses		None	65.00	All Min.	1		Yes	F	X	X			No	No	No	5	A	Yes	No	L	Every	Occ.	No
					15.00	50.00–	All	1 & 2	Any	Yes	F	X	X			Yes	County	None	½	W	Yes	Yes	T–L	Occ.	Yes	Q & F
	Tents	Bldg.	Board	Hotel		25.00	All	1		Yes	F	X	X			None	None	None	2	Train	Yes	No	L	Comp.	Occ.	Spec.
	Tents	Bldg.	Bldg.	Yes	30.00	81.00	Civ.	1–2–3–4	Geol.	Yes	F	X	X	X	X	None	Yes	No	6	A, truck	Restr.	Yes	L	Occ.	Yes	Weekly
	Colle	ege			5.00		Civ. Min.	2	Any	Yes	F	X	X			None	None	Mines	10–30	A	Yes	No	L	Comp.	No	None
	Bunk Hs.	Bldg.	Bldg.	Yes	7.50	45.00	Civ.	1–3	Sophs.	Yes	R	X	X			None	None	None	2	A	Yes	No	N	Every	Yes	None
o	out from	College d	aily.)	Hotel	None		Civ.	1 & 2	All Tech.	Yes	F	X	X	X	X	None	None	None	2	W	Yes	Yes	L	Obs.	None	Oral
	Cabins	Bldg.	YMCA	Hotel	5 & 15	75.00	Civ.	2–3	Non-Civ.	Yes	F	X	X	X		None	Some	None	1	W	Limit	None	No	Yes	Occ.	No F
	C.C.C.	Camp	Bldg.	Yes	10.50	30.00	All Eng.	1 & 2	Any	No	F					None	None	None		Bus	Yes	No	T–L	Occ.	Occ.	Q & F
	(Wooden	buildings)		Yes	35.00 & 50.00	135.00	Civ.	2–3	Any	Yes	R	X	X	X	X	Yes	None	Little	5	A	Yes	No	L	Occ.	Daily	F
(T	ents whe	n in cam	p)	No	25.00		Civ.	2–3	Elect.	Yes	R						Yes	No		T	Yes	No	Yes	Occ.	Occ.	None
(E	ntire cam	p in ten	ts)	Yes	10.00	45.00	Civ.	1–2	No	Yes	R	V	aries			None	Yes	Yes	Var.	T	No	None	Yes	Occ.	Occ.	None
	Cabins	Bldg.	Bldg.	Yes	3.00	35.00	Civ.	2	Any	Yes	R	X	X	X		None	None	None	3	T B	Yes	Yes	L	Obs.	Occ.	None
(E	ntire cam	p in ten	ts)	Yes	20.00	80.00	Civ.	2		Yes	F					None	None	None	2–9	A	Yes	None	L		Yes	None
	Tents	Barn	Tents	Inn	None	15.00	Civ.	2	None	No	F	X	X		X	None	None	None	1½	Var.	Yes	None	No	None	None	None
rm	anent	Perm	anent	Houses	100.00	165.00	All Eng.	1	Any	Yes	R	X	X	X	X	No	No	No	15	A	Yes	Yes	Yes	No	Yes	Yes
							All Eng.					X	X		X	Many	No	No		Bus		Yes	T–L	Yes	Yes	Yes
ge	(All	in Bldg	s.)	Yes	15–25	90–100	All Civ.	1	All	Yes	F	X	X		X	None	Yes	Rare	1	W	Yes	None	T–L	As ne	eded	F
riv	ate Hous	es & Ho	tels)	Hotel	None	35.00	Civ.	2 & 3		Yes	F	X	X	X	X	No	No	No	Var.	W & A	Yes	No	No	Comp.	No	No
ve	from C	oll.)		Bldg.	None	None	Civ.	2		Yes	R	X	X		X	None	No	No	1	A	Yes	No	No	Obs.	Occ.	None
rk	from ca	mpus)				70.00	Civ.	1			F		X		X	No			20	A	Requ.	No	No	Notes	Occ.	Yes
		College			None		All Eng.	2 & 3		No	F	X	X		X	No	No	No	2			No	T–L	Obs.	None	F
Ca	bins)	Bldg.	Priv.	Yes	5.00	12.00	Civ. Min.	2	Any Eng.	Yes		X				No	No	No	6	A	Yes	Yes	Yes	Obs.	No	No
		College					Civ.	2	Any Eng.	Yes	F	X	X	X	X	No	No	No		A	Yes	No	T–L	No	No	Occ.
		Bldg.	Bldg.	Limit	(70.00)		All Eng.	1	Reg.	Yes	F	X	X	X	X	No	No	No	2	W. A. B.	Lim.	Yes	L	Lim.	Yes	Q
	Bldg.		Shack		10.00	100.00	All Eng.	1		No	R		X			No	No	No		W	Yes	No	L	Occ.	Occ.	None
l)		Ho	tel	Yes	40.00	90.00	Civ.	1–2	Any	Yes	F	X	X	X	X	None	No	No	B				L	Yes	Occ.	F
	Dorm.	Bldg.	Bldg.	Yes	None	50.00	Civ. Min.	2	Any	Restrict.	F	X	X	X	X	None	No	No	4–5	W–B	Yes	Yes	T–L	Obs.	Yes	F
	Tents	Bldgs.		Yes	7.50	30–50	Civ.	1–2			F	X	X		X	No	No	No		W & A	Yes	No	No	Yes	Occ.	None
Co.	Bldgs.)	(Mines	Bldgs.)	Yes	20.00	70.00	None	3		Yes	F	(un	derg	rou	nd)	No	No	No		A		None	Yes	Comp.	Occ.	None
	(Permane	nt bldgs.)		Yes	12–36	118.00	All Eng.	1 & 2	Any	May	R	X	X	X	X	Some	No	No	10	W & B	Yes	No	Yes	Obs.	Occ.	F
	Tents		Hotel	Hotel	15.00	40.00	Civ.	1 & 2	Any	Yes	R	X	X		X	No(Rarely)			3	W & A	Near	None	T–L	Obs.	No	F
(Us	ually sum	mer resor	ts)	Var.	None	50–125	Civ.	1 & 2	Any	Yes	Var.	X	X	X	X	No	No	No	Var.	A & W	Yes			2 hrs.		None
nts	Tent	Off. Bldg.	Bldg.	Yes	37.50	110.00	Civ.	2	Any	Yes	Both	X	X	X	X	Yes	Yes	Occ.	5	W & A	Yes	No	T	Comp.	Occ.	Report
	Tents	(Buil	ding)	Hotel	54.00	80.00	Civ.	2	None	Rare	R	X	X		X	No	No	No	1	W	Yes	No	Yes	Occ.	None	None
	Bldgs.	Bldg.	Contract	Yes	20.00	70.00	C.E.M.	1–2–3	None	Yes	R	X	X	X	X	No	No.	No	1	W	Yes	No	L	Occ.	None	F
							All Eng.	2	None	No		X	X		X											
							All Eng.	1	None	No																
	Tent	Tent	Tent	No			All Civ., Min.	1–2	Any	Yes	F		X	X	X	No	No	No	5	W & A	Yes	No	Yes	Yes	Yes	

G-E *Campus News*



IT'S "NEW AMERICAN"

Conceived by General Electric, the "New American" home promises to influence profoundly the trend in American building. The program is sponsored in co-operation with all those professionally interested in building new and better homes.

The modern kitchen is one of the results of this work. It has been changed from just a room where a variety of tasks must be performed to a scientifically planned workshop. It is equipped with electric appliances which do the drudgery of kitchen work silently and easily. The electric range, refrigerator, dishwasher, Disposall unit, and modern lighting are but examples of the improvements which have been made in the home workshop.

The radial wiring system used in the "New American" home was designed for safety and convenience. Plenty of outlets for lights and for appliances are the outstanding features of this system.

The home is thoroughly air conditioned. Conditioned air is not only more comfortable but also more healthful, and the G-E air-conditioning units have been designed to promote such conditions.

With the elimination of wasted space, steps, and time throughout the entire dwelling—with the maximum in health, comfort, and economy—the "New American" home is building a brighter future for the cottage and the mansion.

IN EVANSVILLE

Into the flood zone several General Electric engineers—among them Herbert Duval of Washington University, Eugene Darlington of Oregon State, and Harold Towlson of Clarkson Tech— took two radio-equipped police cars and played an important part in the relief activities along the Ohio Valley.

The equipment included a two-way ultra-short-wave police radio set in each car, a 50-watt headquarters transmitter, and a 150-meter transmitter having its own gas-engine-driven electric generator—in reserve in case of power failure.

One of the engineers reported, "We arrived in Evansville and erected our antenna on the 75-foot tower of a bank building. We were on the air continually, rendering service to the flooded area."

In a further effort to aid flood victims, General Electric sent extra men to the G-E Service Shops in the affected area to speed repair work.

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